60p

YOUR COMPUTER

MARCH 1983 BRITAIN'S BIGGEST-SELLING HOME COMPUTER MAGAZINE Vol. 3 No. 3

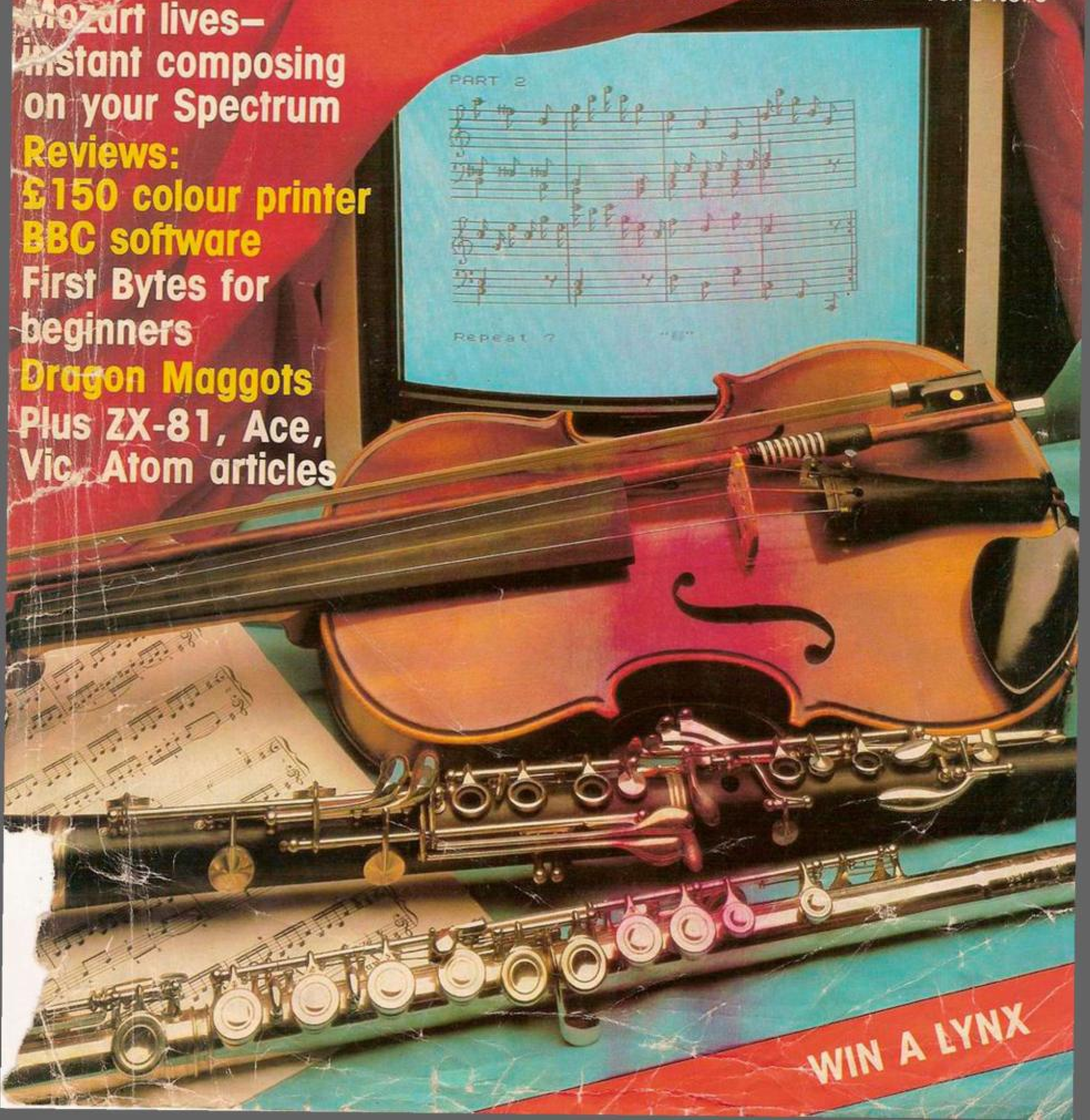
Mozart lives— instant composing on your Spectrum

Reviews:
£150 colour printer
BBC software

First Bytes for beginners

Dragon Maggots

Plus ZX-81, Ace, Vic, Atom articles



WIN A LYNX


SPECTRUM
games
FOR ZX81(16k)
(16k or 48k) ZX SPECTRUM
VIC 20 (ANY MEMORY)
GAMES FOR ORIC AND BBC MICRO AVAILABLE SOON
SPECIAL OFFER £2.00 OFF ANY TWO GAMES THIS MONTH
From our team of outstanding program experts
come games crammed with excitement for hours of fun
HI-RESOLUTION GRAPHICS
SENSATIONAL SOUND EFFECTS
FAST LOADING MACHINE CODE THRILLS
SPECIAL SKILL LEVELS
HALL OF FAME
MISSILE ATTACK
THE ULTIMATE EXPLOSIVE CHALLENGE

YOUR COMPUTER Contents

MARCH 1983

WIN A LYNX Just complete the crossword and think of a slogan to win this 48K colour computer — card between pages 26 and 27.



Mozart: page 54.



CGP-115 printer: page 44.



Vic Boogie — page 81. Below, BBC software: page 50.



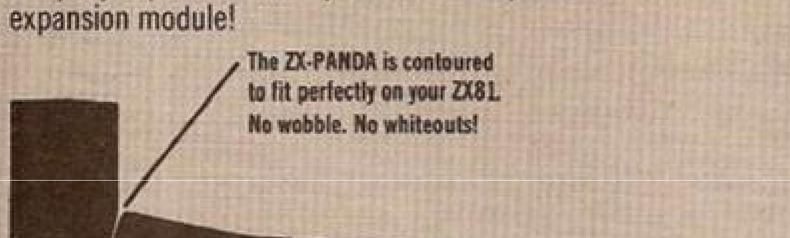
Cover photograph by Stephen Oliver.



THE RAM PACK FOR ZX81 USERS.

The uniquely expandable ZX-Panda. Starts at 16K and expands to 32K in seconds!

The ZX-PANDA is aptly named.
Not only is it an excellent 16K RAM PACK for the ZX81, but it is uniquely expandable at any time to 32K by the addition of an expansion module!



So you can start with 16K . . . and grow bigger later!
ZX-PANDA gives you everything you need from a professionally produced RAM PACK:–

Full 16384 bytes of extra Random Access Memory.
Expandable further to 32K by simple 'plug-in' module.
Custom made case contoured to fit snugly on your ZX81.
Power-on LED.
No additional power supply needed.
Compatible with most expansion systems.
Designed and built in Britain.
Fully tested and guaranteed for 1 year.

ZX-PANDA is the RAM Pack to choose for your ZX81 expansion, because, when you want to grow bigger than 16K . . . it couldn't be simpler!



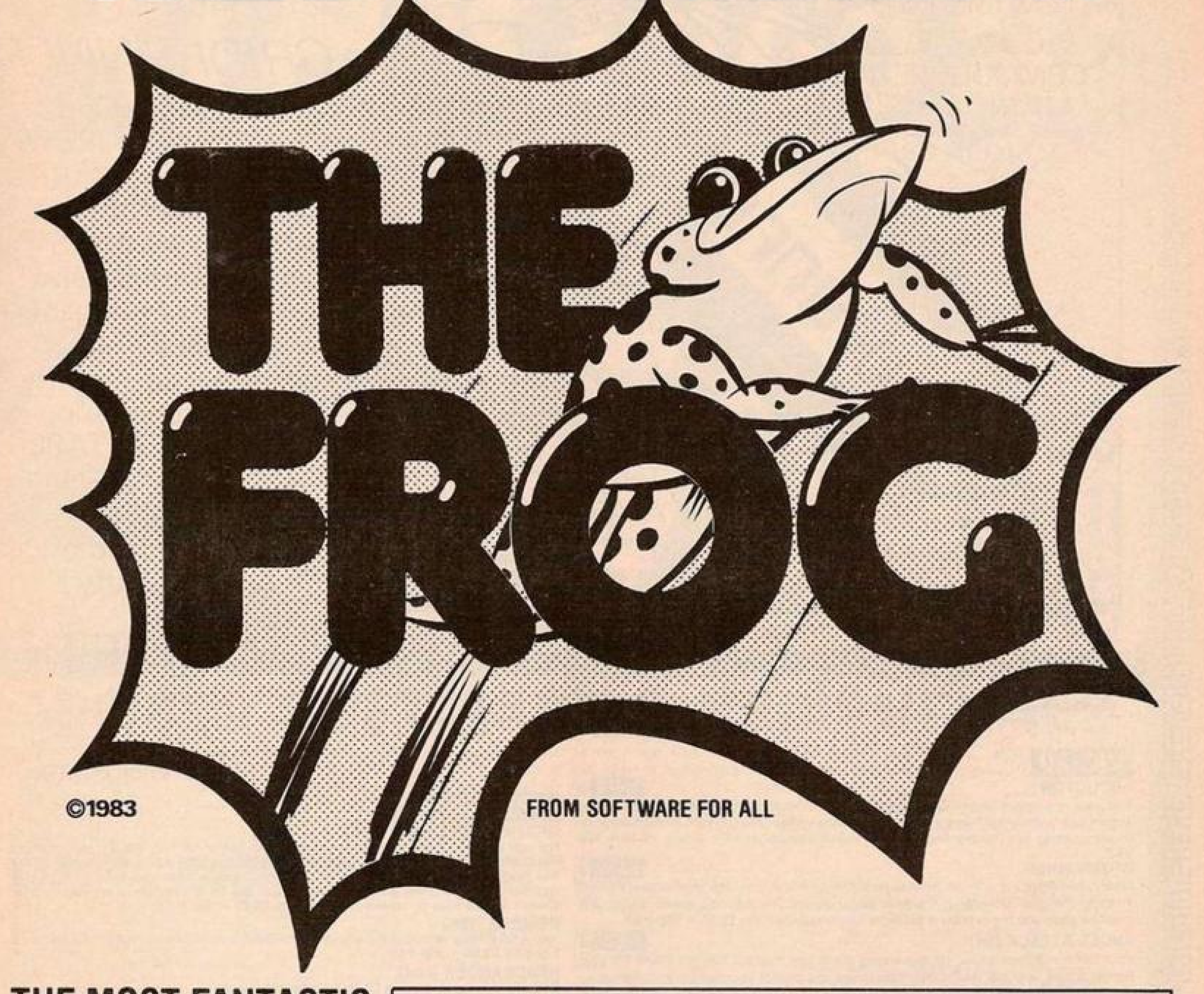
The ZX-PANDA 16K Expandable RAM Pack is available through the following retailers:

Available in the U.K. at:
Greens at Debenhams (all branches).
Wigfalls (all branches).
Artic Computing (Hull).
Data-Assette (London).
Afdec Electronics (Basingstoke).
Fox Electronics (Basingstoke).
Microware (Leicester).
RAM Electronics (Fleet).
Buffer Micro Shop (Streatham).
and other local dealers.

STONECHIP ELECTRONICS
ZX~PANDA
16K EXPANDABLE RAM.

For further information, please write to STONECHIP ELECTRONICS, The Brook Industrial Estate, Deadbrook Lane, Aldershot, Hants. Telephone: (0252) 318260.

THE PROGRAM THAT'S LEAPS AHEAD OF ALL THE REST...



THE MOST FANTASTIC ACTION GAME FOR THE BBC MICRO!

FAST ARCADE PLAY!
MODE 2 COLOUR GRAPHICS AT ITS BEST!
FIVE TUNES!
INCREDIBLY ADDICTIVE!

AVAILABLE NOW
AT YOUR SOFTWARE FOR ALL DEALER

ONLY £8.95

SEE IT NOW AT YOUR NEAREST SOFTWARE FOR ALL DEALER!

A B & C COMPUTERS
11 Brockstone Road
St. Austell
Cornwall PL25 3DW
Tel: 0726 64463

BLADEN COMPUTER SYSTEMS
22 Glynne Street
Farnworth, Bolton
Lancs BL4 DY
Tel: 0204 794226

BYTEWARE LTD.
Unit 25
Handyside Arcade
Newcastle On Tyne
Tel: 0632 617111

CARLTON COMPUTERS LTD.
4 Swanstons Road
Gt Yarmouth
Norfolk NR30 3NQ
Tel: 0493 58898

COMPUTERS FOR ALL
72 North Street
Romford, Essex
Tel: 0708 752862

COMPUTER PLUS
47 Queens Road
Watford
Herts WD1 2LH
Tel: 0923 33927

ESSEX COMPUTER CENTRE LTD.
150 Moulsham Street
Chelmsford, Essex
Tel: 0245 358702/87969

FAREHAM COMPUTER CENTRE
56 High Street
Fareham, Hants
Tel: 0329 239191

GAMES WORKSHOP
1 Dalling Road
Hammersmith, London W6
Tel: 01-741 3445

GAMES WORKSHOP
162 Marsden Way
Arndale Centre
Manchester
Tel: 061-832 6863

GAMES WORKSHOP
Unit 37
Birmingham Shopping Centre
Birmingham B2
Tel: 021-632 4804

GAMES WORKSHOP
95 The Moor, Sheffield
Tel: 0742 750114

MANSFIELD COMPUTERS & ELEC
79 Ratcliffe Gate Mansfield
Notts, NG18 2JB
Tel: 0623 31202

MICROSTYLE
29 Belvedere
Lansdown Road, Bath
Tel: 0225 319705

RAM ELECTRONICS
106 Fleet Road
Fleet, Hants, GU13 8PA
Tel: 02514 5858

RDS ELECTRICAL LTD.
157-161 Kingston Road
Portsmouth
Hants PO2 7EF
Tel: 0705 812478

R.M.K. ELECTRONICS LTD.
Hinton House, Station Road
New Milton
Hants, BH23 6HZ
Tel: 0425 616110

STORKROSE LTD.
44 Shroton Street
London NW1
Tel: 01-258 0409

SUPERIOR SYSTEMS LTD.
178 West Street
Sheffield
South Yorkshire, S1 4ET
Tel: 0742 755005

TECHNOMATIC LTD.
17 Burnley Road
London NW10
Tel: 01-450 1500

WATFORD ELECTRONICS
33-35 Cardiff Road
Watford
Herts WD1 8ED
Tel: 0923 40588

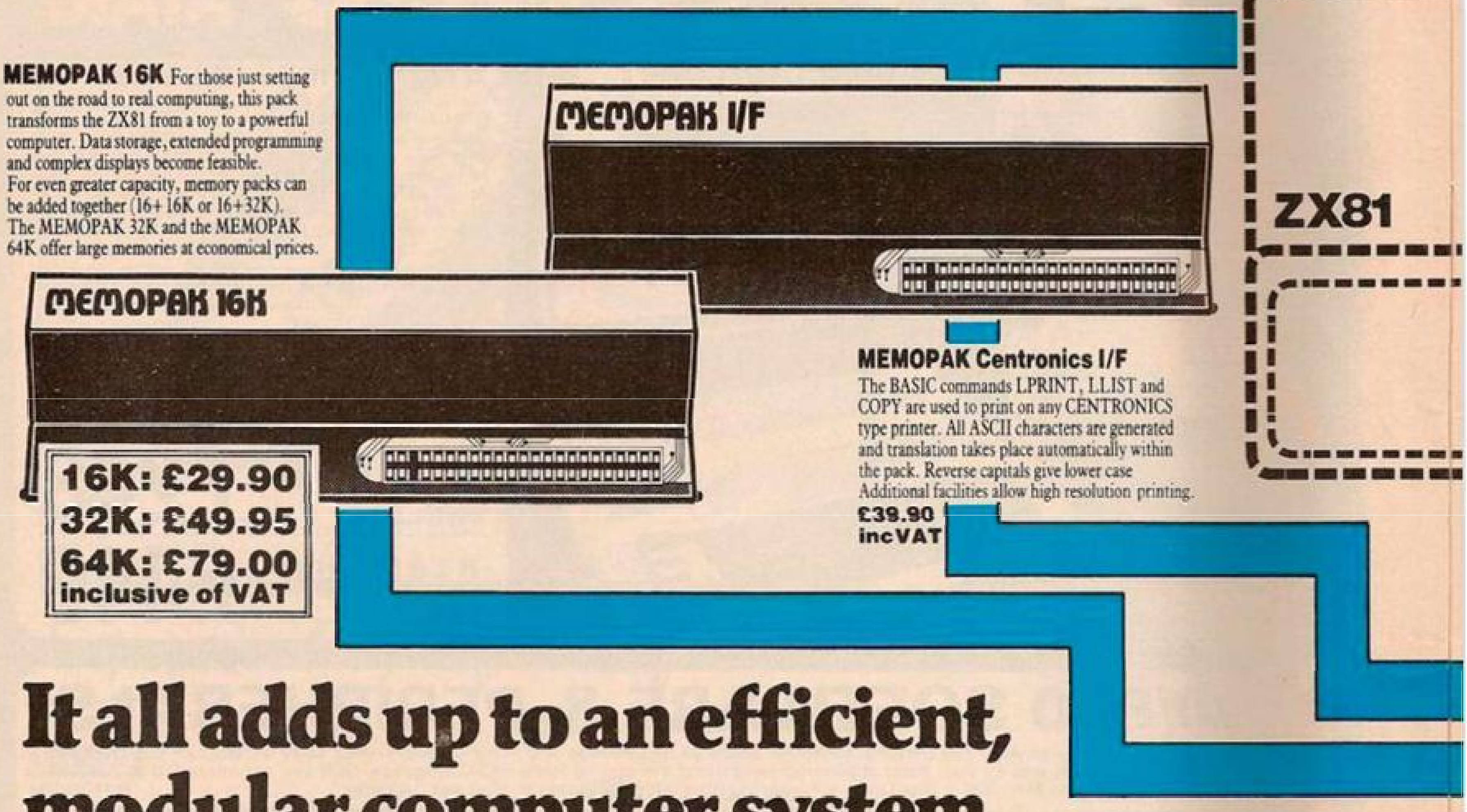
Distributor for Holland, Belgium & Luxembourg:

AACKOSOFT
Postbus 3111
2301 DC Leiden
Tel: 01880 11446

SOFTWARE FOR ALL
"Programs for the people"

At Mem
we realise the poten

MEMOPAK 16K For those just setting out on the road to real computing, this pack transforms the ZX81 from a toy to a powerful computer. Data storage, extended programming and complex displays become feasible.
For even greater capacity, memory packs can be added together (16+16K or 16+32K).
The MEMOPAK 32K and the MEMOPAK 64K offer large memories at economical prices.



MEMOPAK Centronics I/F
The BASIC commands LPRINT, LLIST and COPY are used to print on any CENTRONICS type printer. All ASCII characters are generated and translation takes place automatically within the pack. Reverse capitals give lower case. Additional facilities allow high resolution printing.
£39.90 incVAT

It all adds up to an efficient, modular computer system

The **Memotech** approach to microcomputing is to take the well-proven and popular ZX81 as the heart of a modular system. This small computer houses the powerful Z80A processing unit and acts as the central processor module through which the **Memopaks** operate.

Memotech has a reputation for professional quality, producing units which are designed to fit perfectly, to look well-balanced, and to work efficiently and reliably.

The modular approach gives ZX81 owners the freedom to design the system they really need. Furthermore, the intercompatibility of the modules ensures that later additions will click straight in, to give you a system that grows with your ambitions and abilities.

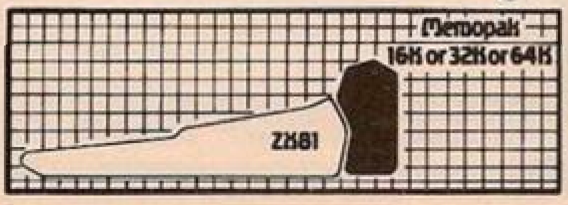
To ensure that your expectations are realised, care is taken at every stage to design features into the system to anticipate your needs. For example:
1) Memories are cumulative e.g. 16K and 32K can be added to the **Memopak 16K** or even to the Sinclair 16K RAM pack. 2) The **HRG** firmware allows commonly used constructions (such as scrolling, shading and labelling graphs), to be called by a few simple commands. **3**) The **Centronics I/F** converts ZX81 character codes into ASCII and extends the print line to the width of the printer, still using the LLIST, LPRINT and COPY commands.

As one example, a system with 16K of memory and **Memocalc** is all that is required to perform the same sophisticated numerical projections as a computer at 10 times the price. The problem may be as complicated as a cash flow or production schedule, or as simple as household accounts or pocket money budgeting. If your bank manager wants to see a cash flow, then a single print instruction to the **Centronics I/F** will give a printout which is more than acceptable.

The example system which is shown, on the other hand, would satisfy the needs of someone who wanted to enter data

How it all fits together

You can see from the diagrams how various Memotech/Sinclair units can be combined.



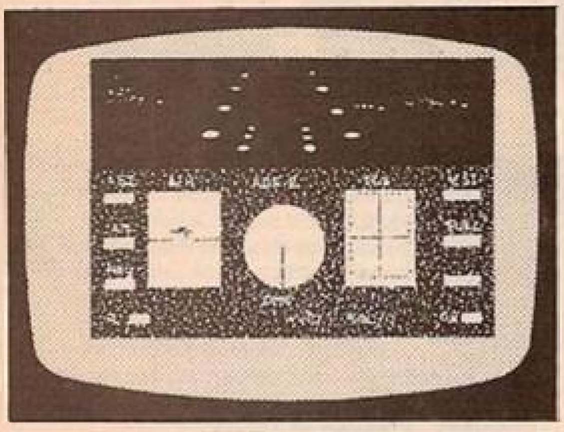




Hewson Consultants

We proudly announce our 1983 range of

SPECTRUM CASSETTES



NIGHTFLITE 16 and 48K FLIGHT SIMULATOR

NIGHTFLITE puts you at the controls of a light aircraft flying at night. You can:
Climb, descend, take off,
Land, bank left or right,
Navigate between beacons,
Raise/lower the flaps,
Raise/lower the undercarriage,
Adjust engine rpm,
Raise/lower the nose varying amounts.

Runway lights appear on approach.
5 modes including Autopilot.
Written by a qualified light aircraft pilot.

A/H	– artificial horizon
ALT	– altitude in ft
HDG	– heading in compass degrees
FL	– flaps up/down
GR	– gear up/down
VSI	– vertical speed indicator
WIND	– wind direction/velocity
DME	– distance measure equipment
ADF	– automatic direction finder
ILS	– instrument landing system
VOR	– VHF omni directional range

▲ **£5.95** our runaway best seller

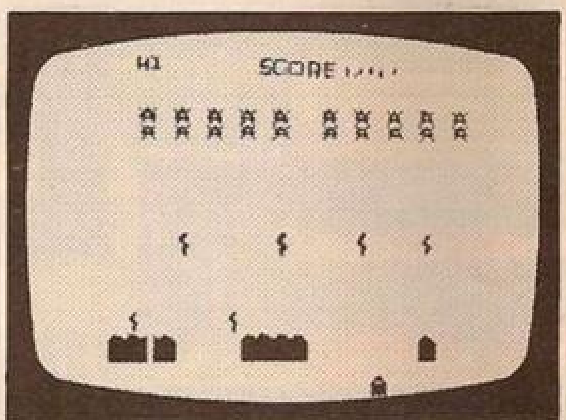
Available through W H SMITHS and many independent micro-computer shops

COMING SOON:– **AIR TRAFFIC CONTROL** – Puts you in command at Heathrow Airport **£5.95**



◀ **£5.95**
All action game

£5.95 ▶
Are you
fast enough?



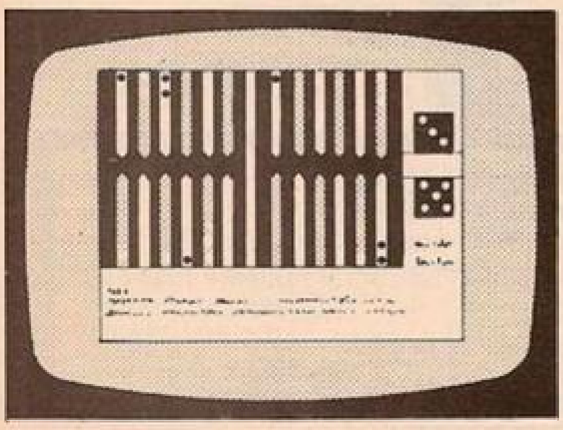
MAZE CHASE
16 and 48K

4 or 8 Mazes, Highest score to date,
4 independent guardians, 3 lives,
Full colour, Fast machine code action.

SPECVADERS 16K

Defeat each squadron of Beeple Zaps and another appears only closer. Cyrian mothership with ejecting Zeetle Baps.

5 levels of play from Orions snails pace to close your eyes and hope. Real time scoring. 3 lives. Pan galactic gargle blaster for highest score. Descending asteriods.



◀ **£5.95**
A real challenge

£5.95 ▶
Another first



BACKGAMMON 16K

8 Levels of play from novice to expert.
Full colour display of tables and dice.
Gamble on a single game or a series, double or quits. All the features of the ancient game.

COUNTRIES OF THE WORLD

16 and 48K on one cassette
Countries of the world is an educational package designed to give an appreciation of the location of all the main countries and some information about them.
16K version displays a world map, shows the position of each country and names its capital.
48K version; all the above plus prints the population, size, currency, and main languages of each country, and statistics on largest and smallest countries etc.

Hewson Consultants
SPECTRUM BOOKS



Available through Computer Bookshops and W H SMITH.

40 BEST MACHINE CODE ROUTINES FOR THE ZX SPECTRUM — £5.95

By Andrew Hewson and John Hardman

Section A: Three chapters explaining what you need to know about Z80 machine code on the Spectrum.

- How to load and save machine code.
- How to use the system variables.
- How memory is organised.
- How program lines are stored.
- How to use the stack, the display, the attribute files.
- How to call ROM routines – where they are and what they do.
- The structure of Z80 code – plus a valuable glossary.

Section B: 40 routines including,

- Scroll – up, down, side to side by pixel or by character.
- Search and replace, token swap, string search.
- Rotate character, invert character – horizontally and vertically.
- Line renumber – including GOSUBs, GOTOs, RUN etc.

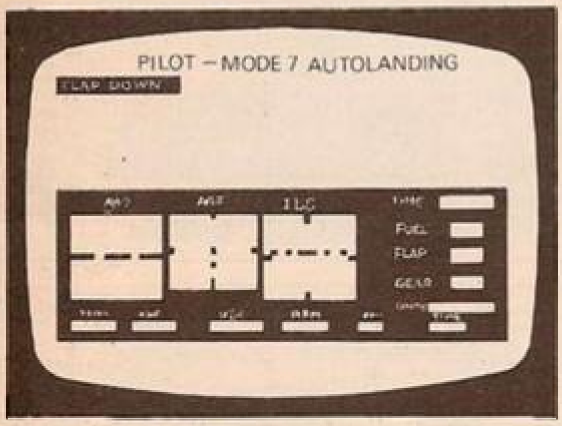
This book teaches the beginner all he needs to know in a simple, easy-to-learn form and its an *invaluable reference work for the expert too!*

20 BEST PROGRAMS FOR THE ZX SPECTRUM — £5.95

By Andrew Hewson

Program titles include:
Machine Code Editor – Write, modify, extend and load machine code using this all-basic program. No need to use an Assembler when you have this program.
Index File – Learn about fixed length records, save numeric and string information, add to, sort, modify, delete and print your records. Ideal as a computer based filing system.
Duckshoot – Learn how to manipulate the attributes file *and* have fun at the same time.
Graphix – Construct up to 210 graphics characters with the full on-screen editing facilities, enhance and modify them and recall them later to build a detailed display to save on cassette.
Spiromania – A program to stretch your artistic talants, imagination and ingenuity. Draws a limitless variety of curves and spirals.
Plus: FOOTBALL, DIGITISER, DIARY and many more.

ZX81 BEST SELLERS



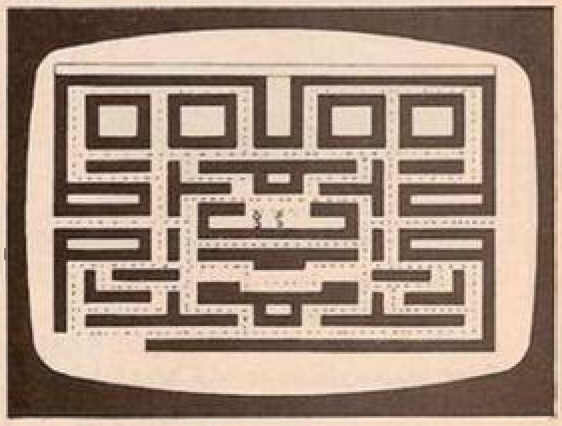
PILOT 16K (ZX81) — £5.95

Fly your own aircraft.
Instruments:
Artificial Horizon,
Automatic Direction Finder,
Instrument Landing System.
Readouts:
RPM, Flaps, Heading etc.



HINTS & TIPS FOR THE ZX81 — £3.95

Passing data between programmes,
Calling subroutines from cassette,
Machine code programmes.
Bits, bytes, addresses and hexodecimal plus much more.



PUCKMAN 16K (ZX81) £5.95

3 Mazes.
Highest score to date.
4 Independent guardians.
Magic strawberriès.

RETAILERS

We are continually on the look out for new outlets. if you are interested in stocking the items advertised here, write to us for our trade rates.

URGENT

We require high quality Spectrum and Dragon software. Good royalties paid. Send your samples today for fast evaluation.

THE PROGRAMS

The programs advertised here are available from computer bookshops with a software stand, and many independent micro-computer shops.

ORDER FORM — Make cheques/PO's payable to Hewson Consultants — YC3

Quantity	Product	Cost

Name ____________ Total ____________
(Block Capitals Please)
Address ____________
____________ Signed ____________
My Access/Barclaycard No. is ____________

Post to: **HEWSON CONSULTANTS,** 60A St Mary's Street, Wallingford, Oxon OX10 0EL.
Tel (0491) 36307.



INTEREST FREE CREDIT NOW! ON:-

Atari, VIC 20, and Dragon

If your order contains over £120 worth of computer hardware apply now for interest free credit by telephoning: Mail-order: (0702) 552911. London Shop: 01-748 0926. Birmingham Shop: 021-356 7292. Southend Shop: 0702 554000 or write to P.O. Box 3, Rayleigh, Essex SS6 8LR.

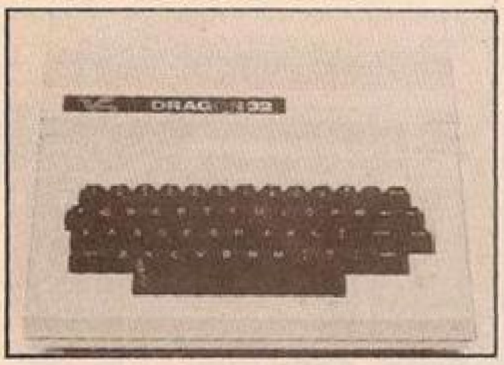
You pay 10% down, then 10% per month for a further nine months (to nearest penny). Example: Atari 400 48K. Cash price £299. Credit terms: £29.90 down, then £29.90 per month for nine months. Total £299. Credit quotations on request. This offer subject to approval which can take up to 48 hours (APR = 0%).

THE NEW COMMODORE 64

The incredible new computer from Commodore comes with 64K RAM fitted! Plus 16 colours hi-res graphics, 320 x 200 pixels, 40 columns by 25 lines, Z80 micro processor can be added — that means you can run CP/M software, 8 independently movable Sprites with collision detection, and a sound generator with 3 voices, 4 waveforms, envelope and filter to rival some dedicated music synthesisers. And all this at the most incredible price ever.

(AF56L) Only £339.00

DRAGON 32



The amazing new British computer with a full-travel standard keyboard, a 16-bit microprocessor, 32K RAM fitted (expandable to 64K and later to 256K!!), 9 colours, hi-res graphics and Microsoft extended colour BASIC (the very best BASIC to learn with). It can be used with virtually any ordinary cassette recorder, it has a printer interface (Centronics-type), joysticks are available and it's incredible value for money.

(AF57M) Only £199.50.

Lots of new Dragon software available.

THE AMAZING ATARI COMPUTERS

4 Consoles Available:
Atari 400, 16K RAM (AF36P) £249.95
Atari 400, 48K RAM (AF37S) £299.00
Atari 800, 16K RAM (AF02C) £399.00
Atari 800, 48K RAM (AF55K) £440.00

★All above with BASIC & handbooks Carriage free, delivery next day by Datapost



Other hardware:

Cassette Recorder	(AF28F)	£50.00
Disk Drive	(AF06G)	£299.95
Thermal Printer	(AF04E)	£265.00
Epson MX80T Mk III	(AF38R)	£399.95
Epson MX80F/T Mk III	(AF40T)	£447.35
Printer Interface for 400	(AF41U)	£59.95
Printer Interface for 800	(AF42V)	£59.95
Interface Module	(AF29G)	£135.00
Versawriter	(AF43W)	£199.95
16K RAM Module	(AF08J)	£55.00
48K RAM Module for 400	(AF44X)	£99.95
48K Upgrade for 400	(AF45Y)	£75.00
Floppy Disk	(YX87U)	£2.50
Le Stick	(AC45Y)	£24.95
Joystick Controllers (Pair)	(AC37S)	£13.95
Paddle Controllers (Pair)	(AC30H)	£13.95



For full details ask for our hardware leaflet (XH54J) SAE appreciated

JOIN THE U.K. ATARI COMPUTER OWNERS' CLUB

An independent users' group. Four issues of the club magazine for only £3.00! Address your subscription to Ron. Issue 1 of the club magazine featured a tutorial on character set redefinition and contained a collection of demonstration and games programs and lots more. Issue 2 featured a tutorial on player/missile graphics, an article about graphics on computers, a selection of members' contributions to the program library and much more.

THE FINEST SELECTION OF ATARI SOFTWARE

Teach Yourself Programs

Conversational French	-5C-16K-YG44X	£39.95
Conversational German	-5C-16K-YG45Y	£39.95
Conversational Spanish	-5C-16K-YG46A	£39.95
Conversational Italian	-5C-16K-YG47B	£39.95
Touch Typing	-2C-16K-YG49D	£19.95
States & Capitals	-1C-16K-YG56L	£14.95
Euro Countries & Capitals	-1C-16K-YG57M	£14.95
•Kids 1 (3 Programs)	-1C-16K-BG00A	£11.75
•Kids 2 (3 Programs)	-1C-16K-BG02C	£11.75
My First Alphabet	-1D-32K-KB23A	£29.95

Learn Programming

Invitation To Programming 1	-1C-8K-YG43W	£19.95
Invitation To Programming 2	-2C-8K-BQ67X	£22.95
Invitation To Programming 3	-2C-8K-BQ68Y	£22.95
•Basics of Animation	-1C-16K-BQ57M	£14.50
•Player Missile Graphics	-1C-32K-BQ59P	£21.25
•Display Lists	-1C-16K-BQ51F	£14.50
•Horiz/Vertical Scrolling	-1C-16K-BQ53H	£14.50
•Page Flipping	-1C-16K-BQ55K	£14.50
•Sounds & Music	-1C-16K-BG04E	£14.50
•Tricky Tutorials First 6	-3C-32K-BG06G	£69.95
Page 6	-1D-24K-KB24B	£27.50

Business Programs

Visicalc	-1D-32K-YL39N	£119.95
Atari Word Processor	-1C&3D-48K-YG42V	£99.95
Text Wizard	-1D-32K-BQ99H	£75.00
•Mini Word Processor	-1C-32K-BG08J	£14.50
File-it 2	-1D-48K-BG10L	£33.87
Filemanager 800	-1D-40K-BG59P	£75.00
Graph-It	-2C-16K-YG51F	£14.95
Statistics	-1C-16K-YG52G	£14.95
Mortgage & Loan Analysis	-1C-16K-BQ66W	£14.95
•Bob's Business	-1C-32K-BG11M	£10.59

Adventure Games

Galactic Empire	-1C-32K-BG14Q	£14.50
Galactic Trader	-1C-32K-KB25C	£14.50
•Galaxy	-1C-16K-BG75S	£14.95
•Rescue At Rigel	-1C-32K-BQ21X	£20.75
•Datestones of Ryn	-1C-32K-BQ22Y	£13.80
•Star Warrior	-1C-32K-BQ24B	£27.45
•Voyager I	-1C-32K-BQ95D	£14.95
•Invasion Orion	-1C-24K-BQ23A	£17.25
•GFS Sorceress	-1C-48K-KB26D	£21.95
•Planet Miners	-1C-24K-BG89W	£11.95
Star Flight	-1D-40K-BG26D	£14.95
•Journey To The Planets	-1C-32K-KB28F	£20.45
•Crush, Crumble & Chomp	-1C-32K-BQ83E	£20.75
Mission Asteroid	-1D-40K-BQ91Y	£17.19
Wizard & The Princess	-1D-40K-BQ25C	£21.79
Ulysses & Golden Fleece	-2D-40K-BQ92A	£20.64
Dr Goodcode's Cavern	-1D-48K-KB04E	£21.95
Escape From Vulcan's Isle	-1D-40K-KB30H	£20.75
Zork I	-1D-32K-BQ94C	£29.95
Zork II	-1D-32K-BQ95D	£29.95
Zork III	-1D-32K-KB31J	£29.95
Ali Baba & The 40 Thieves	-1D-32K-BQ78K	£25.93
•Temple Of Apshai (Part 1)	-1C-32K-BQ85G	£27.45
•Upper Reaches (Part 2)	-1C-32K-BQ87U	£13.80
•Curse Of Ra (Part 3)	-1C-32K-BQ89W	£13.80
Dragon's Eye	-1D-40K-KB32K	£20.75
Crypt Of The Undead	-1D-40K-KB33L	£20.75
•Empire Of The Overmind	-1C-40K-BG73Q	£21.95
King Arthur's Heir	-1D-40K-KB34M	£20.75
•Lords Of Karma	-1C-40K-BG79L	£14.95
Nightmare	-1D-40K-KB35Q	£20.75
Analog Adventure	-1D-32K-BQ33L	£16.95
Adventure Land	-1C-24K-BQ00A	£17.95
Pirate Adventure	-1C-24K-BQ01B	£17.95
Mission Impossible	-1C-24K-BQ02C	£17.95
Voodoo Castle	-1C-24K-BQ03D	£17.95
The Count	-1C-24K-BQ04E	£17.95
Strange Odyssey	-1C-24K-BQ05F	£17.95
Mystery Fun House	-1C-24K-BQ06G	£17.95
Pyramid Of Doom	-1C-24K-BQ07H	£17.95
Ghost Town	-1C-24K-BQ08J	£17.95
Savage Island I	-1C-24K-BQ09K	£17.95
Savage Island II	-1C-24K-BQ10L	£17.95
Golden Voyage	-1C-24K-BQ11M	£17.95
Treasure Quest	-1C-16K-KB36P	£10.95
Softporn Adventure	-1D-40K-BQ93B	£20.64
Deadline	-2D-32K-BQ96E	£37.35
Starcross	-1D-32K-KB37S	£29.95
Energy Czar	-1C-16K-YG53H	£14.95
Kingdom	-1C-8K-YG55K	£14.95
Space Shuttle Module I	-1D-32K-BG65V	£18.95

War Games

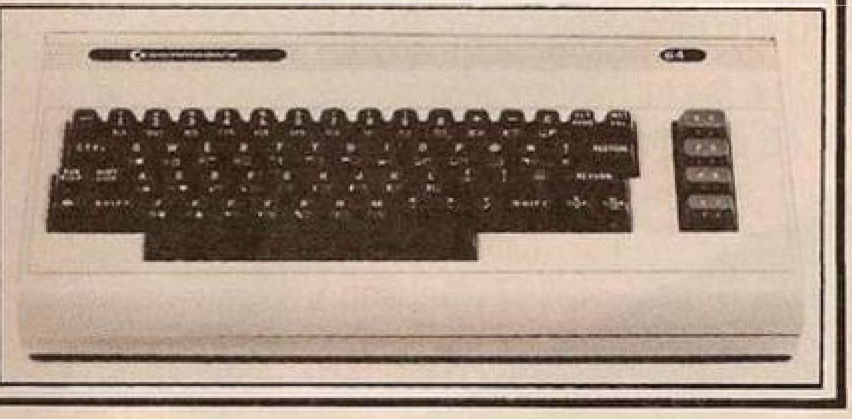
The Shattered Alliance	-1D-48K-BQ98G	£28.95
Legionnaire	-1C-16K-KB00A	£25.95
•The Battle Of Shiloh	-1C-40K-BG63T	£28.95
•Dnieper River Line	-1C-48K-BG71N	£18.95
•Tanktics	-1C-24K-BG93B	£17.95
•Nth Atlantic Convoy Raider	-1C-16K-BG83E	£11.95
•Midway Campaign	-1C-32K-BG81C	£11.95
•Battle For Normandy	-1C-32K-KB38R	£28.95
•Tigers In The Snow	-1C-40K-KB01B	£28.95
War	-1D-32K-KB40T	£17.95
•B1 Nuclear Bomber	-1C-16K-BG68Y	£11.95
•Nukewar	-1C-16K-BG87U	£11.95
•Conflict 2500	-1C-32K-BG85G	£11.95
•Cytron Masters	-1C-32K-KB41U	£28.95

Arcade Games

Star Raiders	-1E-8K-YG66W	£29.95
Choplifter	-1D-48K-KB12N	£27.50

Commodore 64
32 computer hardware







THE NEW MAPSOFT CATALOGUE

48 full colour pages of Atari, Dragon and VIC 20 hardware and software. A comprehensive guide to what's available. Price £1.



THE NEW MAPLIN CATALOGUE

contains full details of all the computers and most of the software shown here and much more. On sale now in all branches of W.H. Smith price £1.25. Or send £1.50 to P.O. Box 3, Rayleigh, Essex.

ATARI SOFTWARE continued

Embargo	-1E-8K-KB43W	£29.95
Caverns Of Mars	-1D-16K-BQ69A	£29.95
K-Star Patrol	-1E-8K-BQ52G	£29.95
•Protector	-1C-32K-BG24B	£27.50
•Space Chase	-1C-16K-BG42V	£10.95
Gorf	-1E-16K-KB44X	£29.95
Andromeda	-1D-24K-KB17T	£22.50
Bomber Attack	-1C-16K-BG70M	£11.95
Asteroids	-1E-8K-YG60Q	£29.95
•Stellar Shuttle	-1C-16K-KB45Y	£23.50
•Race In Space	-1C-16K-BQ35Q	£14.95
Missile Command	-1E-8K-YG64U	£29.95
Space Invaders	-1E-8K-YG70M	£29.95
Deluxe Invaders	-1D-16K-BG34M	£29.95
K-razy Kritters	-1F-8K-BG51F	£29.95
•Rear Guard	-1C-16K-KB47B	£14.50
•Shootout At OK Galaxy	-1C-16K-BG97F	£14.95
•Beta Fighter	-1C-16K-KB49D	£15.50
•Rocket Raiders	-1C-24K-KB51F	£18.50
•Stratos	-1C-16K-KB53H	£24.95
•Galactic Chase	-1C-16K-BQ62S	£16.95
Threshold	-1D-40K-BG18U	£27.54
•Space Games (3 Programs)	-1C-32K-KB55K	£17.95
•Lunar Lander	-1C-24K-BQ16S	£10.95
•Nautilus	-1C-32K-KB13P	£27.50
Seafox	-1D-48K-KB57M	£23.50
•Sea Dragon	-1C-16K-KB58N	£24.95
K-razy Shoot Out	-1E-8K-BQ63T	£29.95
•Shamus	-1C-16K-KB20W	£27.50
Serpentine	-1E-8K-KB60Q	£23.50
Centipede	-1E-16K-BQ70M	£29.95
Angle Worms	-1C-8K-BG50E	£10.95
•Bug Off	-1C-16K-KB61R	£21.95
•Bug Attack	-1C-24K-BG36P	£23.95
•Tutti Frutti	-1C-16K-KB63T	£17.95
•Genetic Drift	-1C-16K-KB65V	£23.50
•Haunted Hill	-1C-16K-BG38R	£19.95
Claim Jumper	-1E-16K-KB67X	£33.95
•Chicken	-1C-16K-BG27E	£27.50
•Canyon Climber	-1C-16K-BG44X	£23.50
•Frogger	-1C-16K-KB68Y	£22.95
•Preppie	-1C-16K-KB07H	£21.95
•Pacific Coast Highway	-1C-16K-BG13P	£23.50
Fire Bird	-1E-4K-KB70M	£27.95
Apple Panic	-1D-32K-KB06G	£23.50
Track Attack	-1D-32K-KB05F	£23.50
Pac Man	-1E-8K-BQ71N	£29.95
Ghost Hunter	-1C-16K-BQ64U	£19.95
•Jawbreaker	-1C-16K-BG17T	£20.64
Mouskattack	-1D-32K-BQ77J	£22.95
K-razy Antiks	-1F-8K-KB16S	£29.95
Pathfinder	-1D-32K-BG33L	£26.66
•Labyrinth	-1C-16K-KB71N	£23.50
•Crossfire	-1C-16K-BG22Y	£20.64
Tumble Bugs	-1D-24K-BG46A	£23.50
Wizard Of Wor	-1D-32K-KB03D	£29.95
•Time Bomb	-1C-16K-BG40T	£10.95
Thunder Island	-1C-16K-BQ37S	£10.95
TT Racer	-1C-16K-KB73Q	£19.95
•Dodge Racer	-1C-16K-BG29G	£27.50
•Matchracer	-1C-16K-BG31J	£22.50
•Baja Buggies	-1C-16K-KB74R	£22.95
•Hazard Run	-1C-16K-KB76H	£21.50
Roadracer/Bowler	-1C-16K-BG99H	£11.95
•Shooting Gallery	-1C-16K-BQ36P	£14.95
•Shooting Arcade	-1C-16K-BG15R	£23.50
Rasterblaster	-1D-32K-BG35Q	£22.95
David's Midnight Magic	-1D-48K-KB78K	£27.50
Super Breakout	-1E-8K-YG67X	£24.95
•Clowns & Balloons	-1C-16K-KB79L	£23.50
Guns Of Fort Defiance	-1C-32K-BG78K	£14.95
Mountain Shoot	-1C-16K-BQ12N	£10.95
•Tank Trap	-1C-16K-YL34M	£8.95

Home Entertainment

Scram	-1C-16K-YG58N	£19.95
Knockout	-1C-16K-KB81C	£14.95
Basketball	-1E-8K-YG61R	£24.95
Cypher Bowl	-1C-16K-BQ20W	£29.50
Sunday Golf	-1C-16K-BQ13P	£10.95
Golf Challenge	-1C-16K-KB82D	£17.19
Tournament & 8 Ball Pool	-1C-16K-BQ45Y	£19.95
•Ricochet	-1C-16K-BG47B	£13.80
Computer Chess	-1E-8K-YG63T	£24.95
Fast Gammon	-1C-8K-YL33L	£16.95

•Gomoku	-1C-16K-BQ18U	£14.95
•Reversi	-1C-16K-BQ19V	£14.95
•Acquire	-1C-16K-BG66W	£14.95
•Stocks & Bonds	-1C-32K-BG91Y	£14.95
Cribbage & Dominoes	-1C-16K-BQ43W	£14.95
•Poker Solitaire	-1C-16K-BQ17T	£14.95
Blackjack	-1C-8K-YG62S	£14.95
Hangman	-1C-8K-YG54J	£14.95
Wordrace	-1D-32K-KB09K	£19.65
Wordrace (Part 2)	-1D-32K-KB10L	£15.66
Abuse	-1D-40K-KB11M	£19.65
Super Cubes & Tilt	-1C-16K-BQ48C	£14.95
Humpty Dumpty Jack & Jill	-1C-16K-BQ38R	£14.95
Hickory Dickory & Baa Baa	-1C-16K-BQ39N	£14.95
British Heritage Jigsaws	-2C-16K-BQ40T	£14.96
European Scene Jigsaws	-2C-16K-BQ41U	£14.95
Video Easel	-1E-8K-BQ72P	£24.95
Micro Painter	-1D-48K-BG56L	£27.50
Paint	-1D-48K-KB22Y	£29.95
Music Composer	-1E-8K-YG48C	£35.95
Movie Themes	-1C-8K-BQ34M	£9.95

Computer Languages

Assembler	-1C-16K-YL32K	£21.95
Syn Assembler	-1D-48K-KB83E	£39.95
Assembler Editor	-1E-8K-YG68Y	£39.95
Macro Assembler	-1D-32K-BQ73Q	£59.95
Basic A+ & Op System A+	-1D-48K-BQ32K	£59.95
Microsoft Basic	-1D-32K-BQ74R	£59.95
Pilot (Educator)	-1E & 2C-16K-BQ75S	£89.95
Pilot (Consumer)	-1E-8K-YG69A	£59.95
QS Forth	-1D-24K-YL29G	£62.95
Tiny C	-1D-48K-BG62S	£67.80
Inter Lisp/65	-1D-48K-BG61R	£99.00

Utilities

SAM (Speech Synthesiser)	-1D-32K-KB15R	£47.19
Programming Aids Pack	-1C-16K-BG60Q	£10.95
•Basic Routines	-1C-16K-KB84F	£24.95
•6502 Disassembler	-1C-8K-YL30H	£9.95
Atari World	-1D-40K-BQ27E	£47.95
•3D Supergraphics	-1C-40K-BQ29G	£31.95
The Next Step	-1D-32K-BG64U	£27.54
K-DOS	-1D-32K-BQ76H	£59.95
Diskey	-1D-32K-KB86T	£17.95
Disk Manager	-1D-32K-BG58N	£27.50
Disk Detective	-1D-16K-BG57M	£23.50
MAC 65 & Op System A+	-1D-32K-BQ30H	£59.95
Telelink	-1E-8K-YG59P	£21.95

•*Disk versions also available though price and memory size may be different.*

Books

Master Memory Map	-XH57M	£4.00
De Re Atari	-WG56L	£16.95
Operating System User's Manual & Hardware Manual	-WA46A	£16.95
Atari Basic-Learning By Using	-WG55K	£5.24
Games For The Atari	-WA47B	£4.45
Atari Basic	-WG05F	£6.80
Atari Sound & Graphics	-WA39N	£8.25
Your Atari Computer	-WA40T	£13.45
6502 Assembly Language Subroutines	-WA05F	£12.45
Advanced 6502 Interfacing	-WA41U	£11.45
Beyond Games (6502)	-WA45Y	£13.00
Computers For People	-WA00A	£8.25
Analog: The Magazine For Atari (6 issues) Annual Subscription	-GG24B	£9.00

Send sae now for our new software leaflet with details of most of the above programs.

Order As XH52G — Issue 3.

Key: C = Cassette. D = Disk. E = Cartridge. 2C = 2 Cassettes etc. 8K, 16K shows minimum memory requirement.

Note: Order codes shown in brackets. Prices correct at time of going to press. (Errors excluded).

VIC20 COLOUR COMPUTER

Hardware

VIC20 Console	(AF47B)	£169.99
C2N Cassette Unit	(AF48C)	£44.95
VIC Printer	(AF49D)	£230.00
VIC Disk Drive	(AF50E)	£396.00
3K RAM Cartridge	(AF51F)	£29.95
8K RAM Cartridge	(AF52G)	£44.95
16k RAM Cartridge	(AF53H)	£74.95

Joysticks and Paddles

Single Joystick	(AC53H)	£7.50
Pair of Joysticks	(AC37S)	£13.95
Le Stick	(AC45Y)	£24.95
Pair of Paddles	(AC30H)	£13.95

Programming Aid Cartridges

Super Expander: 3K RAM and Hi-res graphics	(AC54J)	£34.95
Programming Aid: Additional commands, function Key programming etc.	(AC55K)	£34.95
Machine Code Monitor	(AC56L)	£34.95

Software (all 3K unless stated)

Introduction to BASIC Cassettes

Part 1	(AC57M)	£14.95
Part 2	(AC58N)	£14.95

Game Programs

Avenger Cartridge	(AC59P)	£19.95
Star Battle Cartridge	(AC60Q)	£19.95
Super Slot Cartridge	(AC61R)	£19.95
Jelly Monsters Cartridge	(AC62S)	£19.95
Alien Cartridge	(AC63T)	£19.95
Super Lander Cartridge	(AC64U)	£19.95
Road Race Cartridge	(AC65V)	£19.95
Rat Race Cartridge	(AC66W)	£19.95
Blitz Cassette	(AC67X)	£4.99
Mole Attack Cartridge	(AC85G)	£24.95
Adventureland Cartridge	(AC86T)	£24.95
Pirate Cove Cartridge	(AC84F)	£24.95
Mission Impossible Cartridge	(AC87U)	£24.95
Voodoo Castle Cartridge	(AC88V)	£24.95
The Count Cartridge	(AC89W)	£24.95
Sargon 2 Chess Cartridge	(AC77J)	£24.95
Gorf Cartridge	(AC90X)	£24.95
Omega Race Cartridge	(AC91Y)	£24.95
Another VIC in The Wall Cassette	(AC78K)	£7.00
VIC Panic Cassette	(AC79L)	£7.00
Cosmiads Cassette	(AC80B)	£7.00
Backgammon Cassette (+3K)	(AC81C)	£7.00
VIC-Men Cassette	(AC82D)	£7.00
VIC Asteroids Cassette	(AC83E)	£7.00

Business Programs

Simplicalc Disk (+16K)	(AC92A)	£24.95
Simplicalc Cassette (+16K)	(AC93B)	£19.95
VIC Stock Control Cassette (+8K)	(AC94C)	£19.95
VIC File Disk (+16K)	(AC95D)	£24.95
VIC Writer Disk (+8K)	(AC96E)	£24.95
VIC Writer Cassette (+8K)	(AC97F)	£19.95

Education (CSE & GCE 'O' Level Revision)

All cassette based and require at least 8K expansion memory

English Language	(AC98G)	£9.99
Mathematics 1	(AC99H)	£9.99
Mathematics 2	(BC00A)	£9.99
Biology	(BC01B)	£9.99
Chemistry	(BC02C)	£9.99
Physics	(BC03D)	£9.99
Computer Studies	(BC04E)	£9.99
Geography	(BC05F)	£9.99
History	(BC06G)	£9.99
Arithmetic for 9 to 11 year olds	(BC07H)	£9.99
Reading for 9 to 11 year olds	(BC08J)	£9.99
General Knowledge for 9 to 11 year olds	(BC09K)	£9.99
Spelling for 9 to 11 year olds	(BC10L)	£9.99

Home Programs

All cassette based and require at least 8K expansion memory

Quizmaster	(BC11M)	£9.99
Know Your Own IQ	(BC12N)	£9.99
Junior IQ	(BC13P)	£9.99
Know Your Own Personality	(BC14Q)	£9.99
The Robert Carrier Family Menu Planner	(BC15R)	£9.99
VIC Money Manager	(BC16S)	£9.99
VIC Road User & Highway Code	(BC17T)	£9.99
Garden Planner	(BC18U)	£9.99
Interior Designer	(BC19V)	£9.99
BBC "Ask The Family"	(BC20W)	£9.99
BBC "Mastermind"	(BC21X)	£9.99
"Mastermind" additional General Knowledge		
Data 1	(BC22Y)	£2.50
Data 2	(BC23A)	£2.50
Data 3	(BC24B)	£2.50
Data 4	(BC25C)	£2.50
"Mastermind" additional Specialist Knowledge		
Wine & Food	(BC26D)	£2.50
Music	(BC27E)	£2.50
Sport & Games	(BC28F)	£2.50
Films & TV	(BC29G)	£2.50

Books About VIC

Learn Programming on the VIC	(WA31J)	£2.50
VIC Revealed	(WA32K)	£10.00
VIC Programmers *Reference* Guide	(WA33L)	£9.95
VIC Graphics	(WA48C)	£10.00

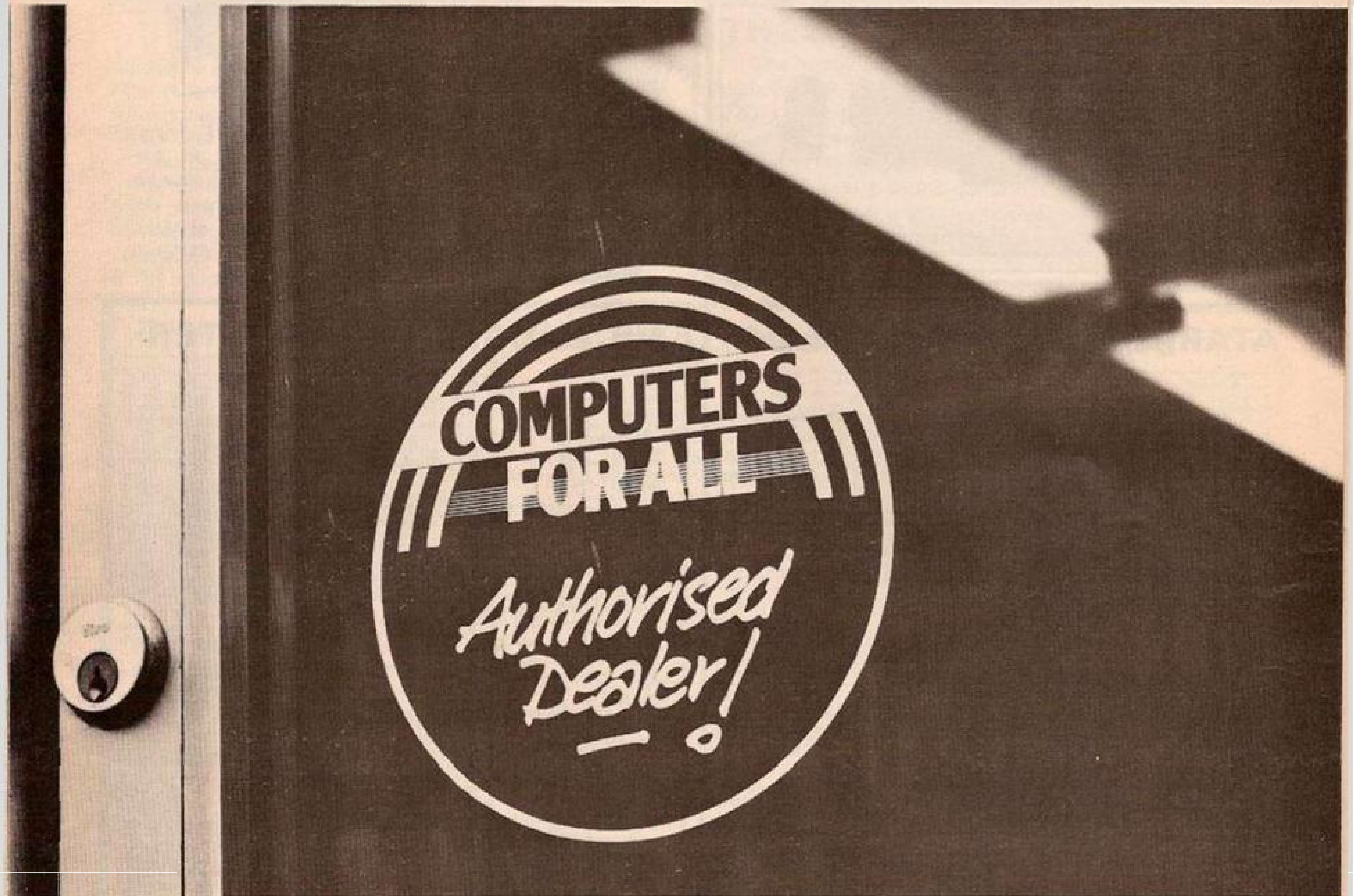
Lots of new VIC20 software now available.

MAPLIN

Maplin Electronic Supplies Ltd., P.O. Box 3, Rayleigh, Essex. Tel: Southend (0702) 552911/554155.

Demonstrations at our shops NOW. See the computers in action at 159-161 King St., Hammersmith W6. Tel: 01-748 0926. 284 London Road, Westcliff-on-Sea, Essex. Tel: (0702) 554000 Lynton Square, Perry Barr, Birmingham: Tel: (021) 356 7292.

IF YOU WANT PROFESSIONAL DEALER THERE'S A NEW



From now on, you won't have to look far for a totally professional home computer dealer.
Just look for the name that says it all. **COMPUTERS FOR ALL**
It's the newest and most exciting network of Micro dealers in the U.K.
The ideal places to buy, browse, seek advice and after-sales service . . . professional service!

Every COMPUTERS FOR ALL dealer is dedicated to giving you, the customer, exactly what you have always wanted . . . a shop or store that knows about computers, capable of helping you sort out what's right for your needs; expertise in giving sound advice, knowledgeable in technical matters.

If you've ever bought from the usual retailer who just stocks and sells, you'll appreciate the difference!

A COMPUTERS FOR ALL dealer is a shop where people matter . . . why not call in at your local one today. You'll get a friendly welcome!

ANIROG SOFTWARE

KRAZY KONG **16K VIC 20**
All the thrills of the arcade game have been brought to life on this expanded screen, extra large characters and multi-screen presentation. Rolling barrels, hammer etc. are featured in the action inside King Dong's lair as you try to rescue the boy he has abducted. K.B./J.S. £6.

ZOK'S KINGDOM **16K VIC 20**
An afternoon stroll turns into a nightmare. A footslip and you fall down the biztual hole leading to the middle earth kingdom of ZOK. A harsh and cunning ruler by any standards. You are challenged to a battle of wits and endurance as the battle for survival starts in earnest.
K.B. £6

DRACULA **3K VIC 20**
Count Dracula is asleep somewhere in his castle. He rises at mid-night and you must find him and drive a stake through his heart before he rises. A multi-screen graphic adventure.
K.B. £6.

HOPPER **16/48K SPECTRUM**
SPECTRUM version of FROGGER with same features and brilliant graphics. K.B. £6.

PHARAOH'S TOMB **16K VIC 20**
A graphical adventure game set in a pyramid. Once you enter, the only way out is with the aid of a key which unlocks the mystery of the Pharao's tomb. Beware of the mantraps the ancient Egyptians so painstakingly built. One false move and you will meet the same fate as befell other tomb robbers over thousands of years.

FROGGER **UNEXP. VIC 20**
Popular arcade game. All machine code with brilliant colour graphics and sound effect. Features include snakes, crocodiles, lady frogs, turtles, cars, lorries and logs
K.B./J.S. £6

CAVERN FIGHTER **UNEXP. VIC 20**
All M/C version of SCRAMBLE. Lasers, bombs, continuous scoring and sound effects give all the thrills of arcade game. Pilot your space ship through the tortuous tunnels and caverns destroying enemy missile launchers, fuel dumps and airborne fire saucers. Four ships to complete mission. 10 skill levels. K.B./J.S. £6

CRAWLER **UNEXP. VIC 20**
Armed with a laser gun, you must destroy the centipede. Destroy his mushroom cover and his allies mushroom laying flea and the homing spider. Fast and furious game.
J.S. £6.

SEVEN PROGRAMS (VOL 1) **UNEXP. VIC 20**
This exciting collection of seven games, all in Hi-Res graphics include popular board game Othello plus Bomber, Slalom, Bounce Out, Snake, Memory and Lunar Docker.
K.B. £6.

SEVEN PROGRAMS (VOL 2) **UNEXP. VIC 20**
This pack with all games in Hi-Res graphics contains graphical adventure game Goblin's Gold plus Ghosts, Breakout, Dare Devil, Minefiled, Grand Prix and Cobra.
K.B. £6.

TINY TOTS SEVEN **UNEXP. VIC 20**
Seven games for young children. All games are in Hi-Res graphics with bright graphics. The games include Super Snap, Simon, Bombs Away, Noughts and crosses, Duck Shoot, Mad Drivers and Santa. K.B. £6



GENEROUS DEALERS DISCOUNT AVAILABLE

AREA AGENCIES AVAILABLE.

SOFTWARE WRITERS
We are looking for top class writers to join our growing software team. If you have written a quality game for VIC 20, SPECTRUM, DRAGON 32, ORIC 1 or COMMODORE 64, then contact us. We pay top royalties for accepted programmes.

ANIROG AT CO-OP CRAWLEY

Huge selection of software and Computer Books for
SPECTRUM — ZX81 — VIC 20 — DRAGON 32 — COMMODORE 64
Most of the software and add-on's advertised in this magazine for these computers available across the counter.
Manufacturer's appointed dealers for **DRAGON 32 — VIC 20 — COMMODORE 64 and ORIC** home computers. We stock full range of peripherals (disc drives, printers and memory expansions) and support software. Come and see us for expert advice and comprehensive service.

MAIL ORDER
ANIROG COMPUTERS
26 BALCOMBE GARDENS
HORLEY SURREY

Payment By Cheque/ P.O./Access or Visa
CREDIT CARD SALES
HORLEY (029 34) 6083/ 2007

South London's Largest Micro Computer Centre

VISION STORE

In Stock Now

COMMODORE 64



64k £345.00

Vic20 5k **£137.95** 21k **£177.90**
includes 5 Free programmes.

VIC Cassette **£44.00** VIC 1541 Disk Drive **£299.95**
VIC Printer **£229.00** NEW 16K RAM Pack **£39.95**

NEW Ideal for Commodore computers
Seikosha GP100 VC Printer **£239.95**
Commodore 64 Software Now in Stock

Main Commodore Dealer for:
New 500 series, New 700 series Business Computers.

ATARI 400

16K £189.95 Less Basic

48K £263.50 Less Basic



Basic Cartridge **£34.90**
48k Up Grade for Atari 400 **£73.50**

Atari 800 16K inc basic	**£399.00**	Atari 410 Cassette	**£49.00**
Atari 800 48K inc basic	**£469.95**	Atari 810 Disk Drive	**£299.00**
		Atari 822 Printer	**£199.95**

Plus Daisy Wheel and Dot Matrix printers for the Atari range.

NEW **Atari 400** Typewriter keyboard. Direct easy replacement for standard keyboard **£78.95**

New Vic Software

Krazy Kong!
Dodge Kong's barrell's as you climb the stairs.
STD VIC. Joysticks. **£6.99**

Exterminator!
Blast the centipede while dodging the spider amongst the toadstools. Fast action.
STD VIC. Joysticks **£6.99**

Anti-splatter-matter!
Make space invaders look like childs play, superb graphics.
STD VIC. Joysticks. **£6.99**

Vikman
Choose one to three ghosts.
STD VIC. Joysticks **£6.99**

3-D Man
Brilliant! You are down in the maze like a Pac-Man, dodge the ghosts and find your way out!
Expanded VIC Joystick **£9.95**

Motorway Maniac
Accelerate towards on-coming traffic while dodging from lane to lane!
Expanded VIC Joystick **£9.95**

Defender on Tri
Guide your ship through the maze on 4 different screens. Fantastic colour and graphics.
Expanded VIC Joystick **£9.95**

100's of other programs.
Send for VIC price List.

Largest Stocks of Software in South London. Available on Cassette, Disk or Cartridge. Massive ranges for:
Atari, Spectrum, ZX81, BBC and Dragon.

Printers

We carry a wide range of printers including:

Amber Dot Matrix	**£89.95**
Seikosha GP100A	**£229.95**
Epson MX80FT3	**£389.95**
Smith-Corona Daisy Wheel	**£549.95**

Cables and interfaces for most home micro's in stock.

THE AMAZING ORIC-1

Colour Computer



- **40 Columns × 28 rows.**
- **Microsoft Basic**
- **8 Colours.**
- **Built-in Sound Synthesiser.**
- **High Res Graphics.**

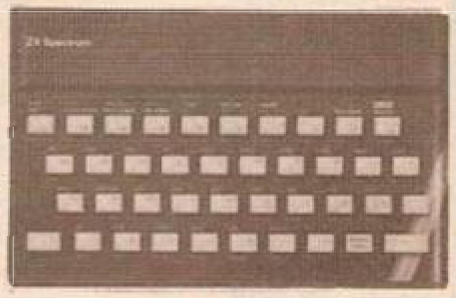
48K Microsoft Basic **£169.95**
16K Microsoft Basic **Phone!**

Come in for a Demonstration.

Sinclair Spectrum Colour Computer

16K	**£123.95**
48K	**£173.95**

We carry massive stocks of Software for the Spectrum.



Sinclair ZX81	**£49.95**
16K RAM	**£27.95**
Printer	**£59.95**

DRAGON 32 £198.95

Limited stocks available. New software coming in all the time. Come in for a demo or send for our list.

Over 900 software programmes always in stock. We carry probably the widest range with continuous demonstrations.

We offer excellent part exchange deals or cash for your old machine.

Export

All our hardware and software is available Tax-Free to overseas customers, please send for our comprehensive list.

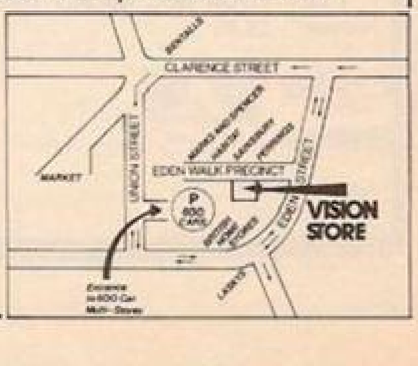
All our prices include VAT
Mail Order — send for our comprehensive list.

Ask about our Credit Facilities

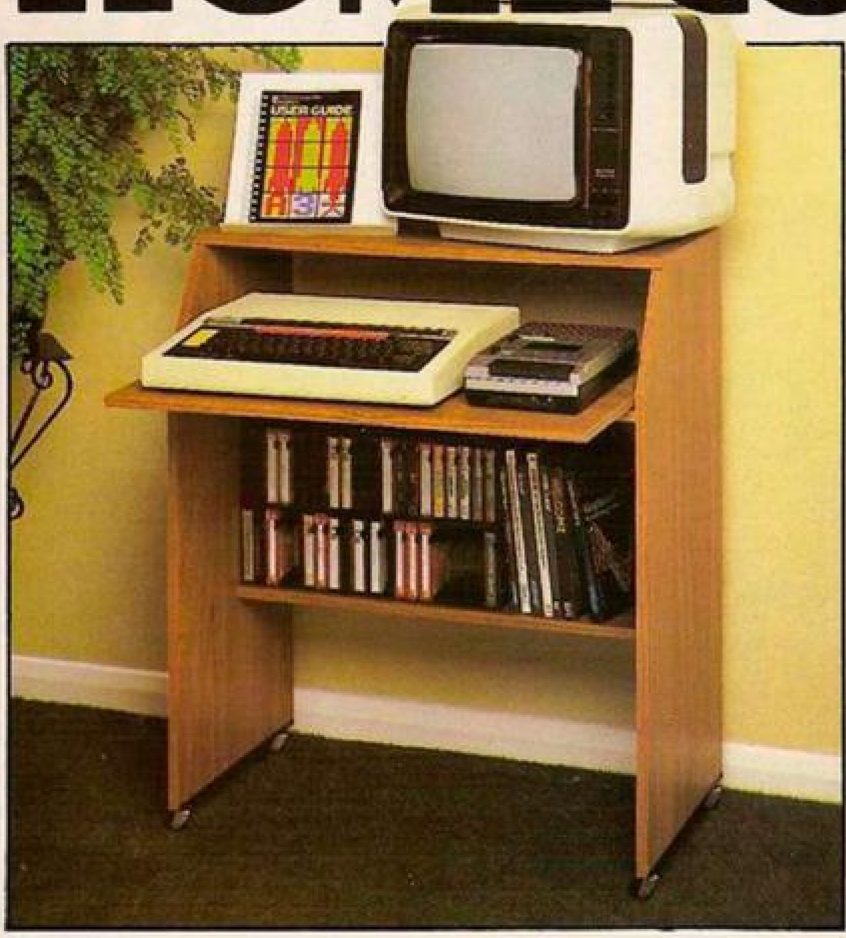
Access/ Barclaycard

VISION STORE

3 Eden Walk Precinct,
Kingston-on-Thames, Surrey.
Tel: 01-546 8974

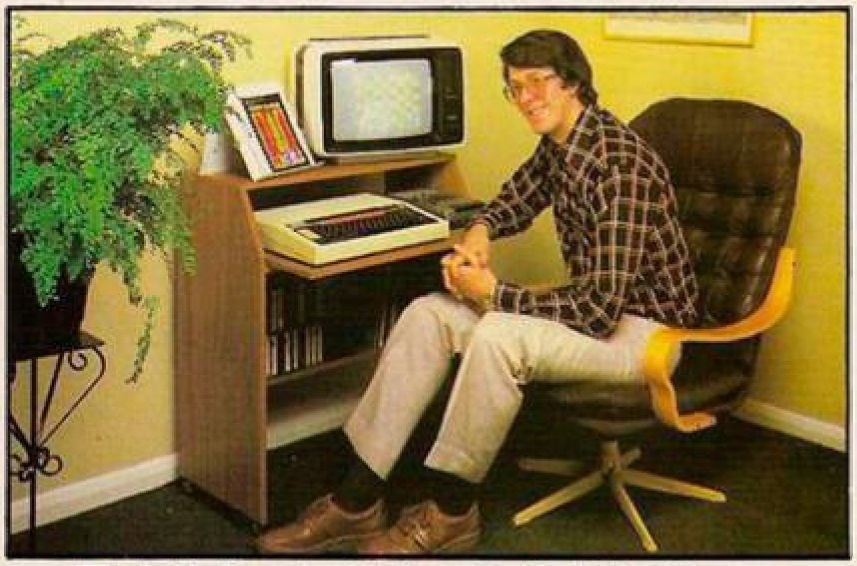


THE IDEAL HOME FOR YOUR HOME COMPUTER



The System Care Desk - made specially for home computer systems. Designed as a neat, smart piece of furniture for your home.

£49·95



Exhibited at the P.C.W. Show and the Northern Computer Fair

And now including design features based on our discussions with home computer users. Send for yours TODAY.

● Supplied as a flat-pack. Easily assembled. Full instructions provided.
● Smart teak effect finish.
● All cables can be neatly and safely 'hidden.'
● Ergonomically designed. Sliding shelf positions the keyboard at the right distance from the screen to suit you. Slides away after use. Saves space.
● Easi-glide castors allow you to move your computer installation where you want it.
● Houses computer, disk drive / cassette recorder and monitor, with ample space for tapes, books etc.
Overall height - 0.83m.
Computer shelf height - 0.70m.
Width - 0.70m.
Depth (with shelf closed) - 0.38m.

system care
At home with your computer.

NOW **AVAILABLE TO YOU BY MAIL ORDER DIRECT FROM THE SUPPLIER.**

Micro Aids, 2 Boston Close,
Culcheth, Warrington, WA3 1BR

ORDER BY FREEPOST - send the coupon or order in writing along with your cheque or postal order in an envelope - no stamp needed. Please allow up to 28 days for delivery. And there's a 14-day money back option, in the event that you're not fully satisfied with your purchases.

4-WAY MINIATURE MASTER PLUG



Provides you with just one 13 amp mains input for up to four 6 amp max outputs to a total loading of 13 amp. Tidy. Safe. Fully insulated.

£8·95

(Only available with orders for the System Care Home Computer Desk).



FREE

A pack of cable tidies with every desk ordered. To ensure safe operation and improve appearance.

To: Micro Aids, FREEPOST, 2 Boston Close, Culcheth, Warrington, WA3 1BR

ORDER

QTY	ITEM	ITEM PRICE	TOTAL
____	System Care Desk	£49.95	____
____	4-Way Master Plug	£8.95	____
		Post / Pkg	£4.95

I enclose a cheque/postal* order payable to Micro Aids for £ ____

* Please delete as applicable.

Signature ____

PLEASE PRINT
Name: Mr/Mrs/Miss: ____

Address ____

____ Tel: ____

FREEPOST - no stamp needed. Prices apply to U.K. only. Export prices on application.

Three out of every four computers going into schools are BBC Micros. Is there a lesson to be learned by every user?

As part of the current government subsidised scheme aimed at introducing micros to schools, the Department of Industry undertook a survey of machines available and made recommendations to education authorities all over the country.

The BBC Micro met their priorities exactly: it is economical yet fast and powerful, and it can justify the investment involved, through its capability to grow with the needs of the user and with the rapid changes in technology.

Teachers and education authorities agreed, and today it represents over three-quarters of all micros being ordered for schools across the country under the DOI scheme.

<u>The BBC's choice too.</u>

In choosing a machine to put their name to for their massive Computer Literacy Project, the BBC had the same set of priorities as the DOI. The BBC Micro is now an integral part of that project, which includes books, software, courses and a number of major television series, one of which, "Making the Most of the Micro" is now being broadcast.

<u>All this for only £399.</u>

The BBC Micro is light and compact. It generates high resolution colour graphics, and is capable of synthesising music and speech using its own internal speaker. The keyboard uses a conventional layout and typewriter feel.

The most sophisticated version (called Model B) is available for only £399. (There is also a basic model available, the Model A, at £299.)

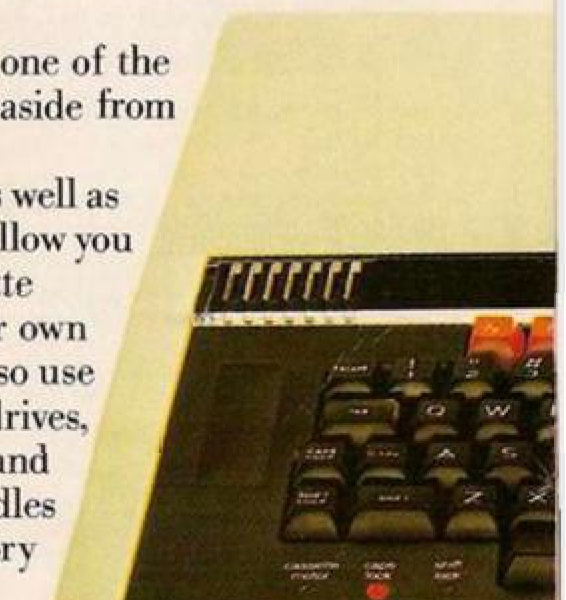
<u>Designed to grow.</u>

Last year the magazine "Which Micro?" said that the most attractive and exciting feature of the BBC Microcomputer was its 'enormous potential for expansion'.

This is indeed one of the features that sets it aside from the competition.

For example, as well as interface sockets to allow you to connect to a cassette recorder, and to your own television, you can also use video monitors, disc drives, printers (dot matrix and daisy wheel) and paddles for games or laboratory use.

You can also plug in ROM cartridges containing games with specialist application programs.



<u>The Tube. A unique feature.</u>

The Tube, which is unique to the BBC Micro, provides for the addition of a second processor via a high speed data channel. The possibilities are enormous. For example, the addition of a second

3MHz 6502 processor with 64K of RAM doubles processing speed. While a Z80 with 64K of RAM opens the door to a fully CP/M* compatible operating system, with all the benefits for business applications.

Linking up with other computers.

The BBC Micro also offers a facility of immense potential value to schools, colleges and businesses. It's called Econet® – a system which uses telephone cable to link with other BBC Micros. A number of machines can then share the use of expensive disc drive and printer facilities.

Make full use of Prestel & Teletext.

With special adaptors you will not only be able to turn your TV set into a Prestel terminal and Teletext receiver, but you can also take data and programs direct from these services. (The programs, which are known as telesoftware, are already being broadcast by BBC's Ceefax service.) This is another first for the BBC Micro.

BASIC plus.

A sophisticated version of BASIC has been chosen for the BBC Micro, which incorporates features normally found only in more advanced high level languages. However, there is also a facility allowing access through a simple command to another language – for example, PASCAL, FORTH and LISP.

*Trademark of Digital Research.



A full range of software.

Applications software for the BBC Micro already cover a very wide field. Packages covering games, education and business applications are available on cassette. All developed to the same high standards set by the hardware.

The best possible back-up.

Your BBC Micro comes with the backing of the BBC and an extensive dealer and service network.

Each approved dealer is able to offer advice and carry out expansion work and repairs.

BBC Microcomputer – Model A and Model B.
2MHz 6502A Processor.
32K ROM; 16K RAM Model A, 32K RAM Model B.
Full QWERTY keyboard with 10 user-definable function keys.
Mixed high resolution graphics and upper and lower case text.
300 baud and 1200 baud interface for standard cassette recorders.
Three-voice music synthesis with full envelope control feeding internal loudspeaker.
Interface sockets (Model B only) – RS423, for analog inputs centronics and user port.
6502, Z80, 16032 second processors.
Single and Dual Disc Drives with 100 and 800 K-bytes storage.
Teletext unit.
Speech synthesis.
Networking facility – via Acorn Econet®

How to buy your BBC Micro.

If you are a credit card holder and would like to buy a BBC Micro B, or if you would like the address of your nearest stockist, just phone 01-200 0200.

Alternatively, you can buy a Model B directly by sending off the order form below to: BBC Microcomputers, c/o Vector Marketing, Denington Estate, Wellingborough, Northants, NN8 2RL.

All orders are despatched by fully insured courier and come complete with easy to follow 500 page User Guide and Welcome cassette.

☎ 01-200 0200 credit card holders.

To BBC Microcomputers, c/o Vector Marketing, Denington Estate, Wellingborough, Northants NN8 2RL.

Please send me________ BBC Model B Microcomputers at £399 each, inc. VAT and delivery. I enclose PO/cheque payable to Acorn Computers Limited Readers A/C or charge my credit card.

Card Number________________
Amex/Diners/Visa/Access (Delete)

Name________________

Address________________

________________ Postcode________

Signature________________ YC3

Registered No. 140 3810 VAT No. 215 400220

The BBC Microcomputer System.

Designed, produced and distributed by Acorn Computers Limited.



VIC software will expand your horizons. And your mind.

PRICES RANGE FROM £4.99 to £24.95 INC. VAT.

commodore
VIC 20

For more information, a catalogue of VIC software and details of your local retailers or dealers, please phone or complete the coupon and send to:
The Commodore Information Centre,
675 Ajax Avenue, Slough, Berkshire SL1 4BG.
Telephone: Slough (0753) 79292.

Name ____________________
(MR./MRS./MISS)
Address ____________________

____

Postcode ____________________

VCYOC0383

For the best hardware, the best software.

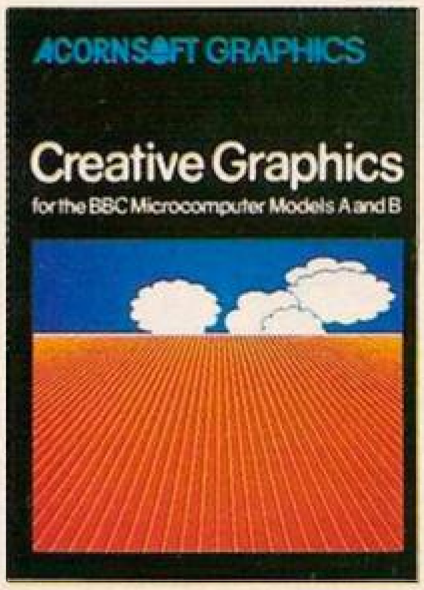
The BBC Microcomputer system is generally regarded to be the best micro in its price range you can lay your hands on. So, if you're thinking of buying one or already own one, you'll want to know about the software that's been specially designed for it.

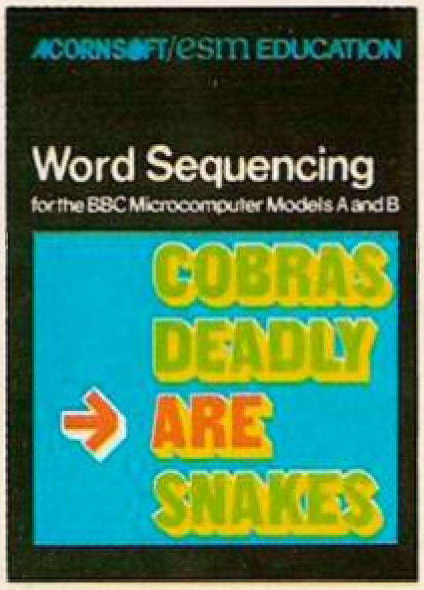
Not surprisingly, it's made by Acornsoft, the software division of Acorn Computers Ltd., who designed and built the BBC Microcomputer. So naturally you can expect the highest quality software with the built-in ingenuity to fully exploit the BBC Micro's potential.

Further education for everyone.

Creative Graphics, which includes the book 'Creative Graphics on the BBC Microcomputer' (price £17.45), provides 36 programs on cassette producing a spectacular range of pictures and patterns in full colour, including animated pictures, recursively-defined curves and three dimensional shapes.

Word Sequencing (price £11.90) contains three word sequencing programs on cassette. Each program presents a series of jumbled words which must be arranged on screen to form either a proverb, nursery rhyme title or a sensible sentence.

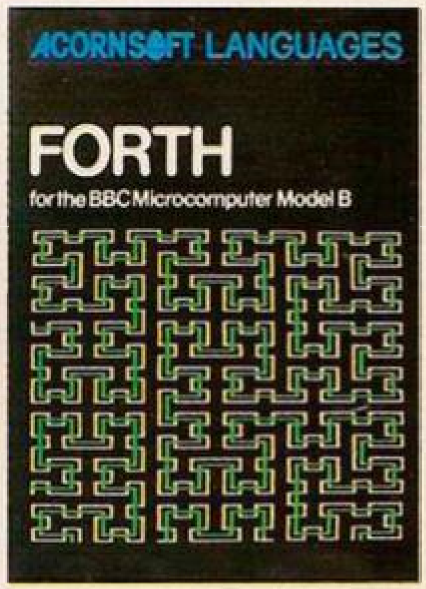




Learn more languages.

LISP (price £24.35) is the fundamental language of artificial intelligence research.





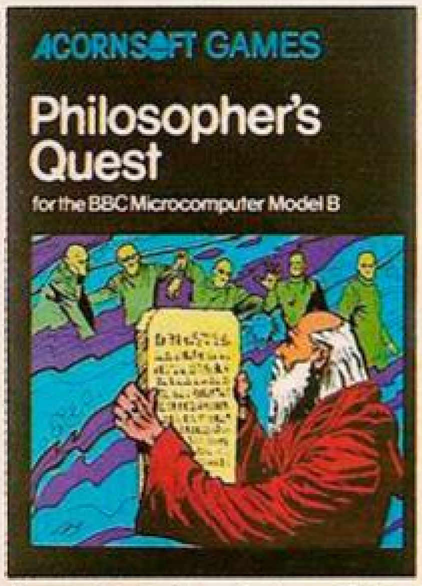
It consists of 5.5K of machine code interpreter, plus 3K of initialised LISP work-space containing utilities and constants. It comes complete with a book that introduces you to programming in LISP, as well as some fascinating applications.

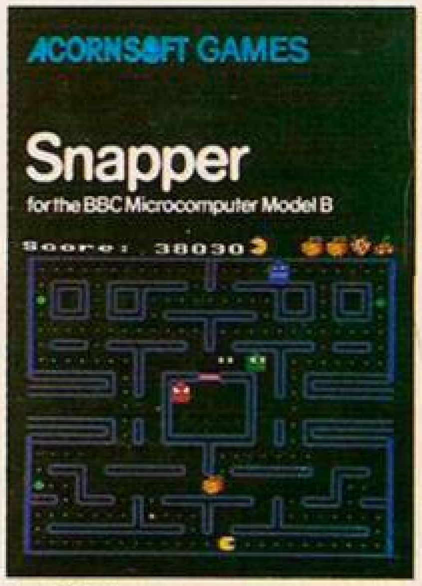
FORTH (price £24.35) is a complete implementation of the FORTH language to the 1979 standard specification for the BBC Microcomputer Model B. This much acclaimed programming language is also accompanied by a specially written book explaining all you need to know.

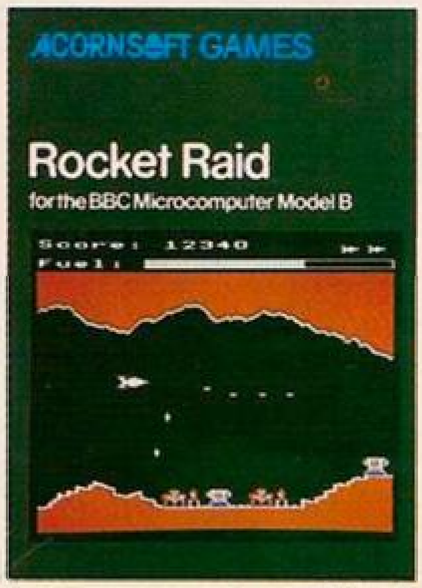


Mind-boggling games.

Philosopher's Quest (price £9.95) is an advanced adventure in which you tell the computer what you want to do and it







describes back in plain English your progress through a fascinating world of fiendish puzzles to be solved.

Snapper (price £9.95) is a colourful game where you guide your 'snapper' through the maze, eating dots and fruit and avoiding the creatures that chase you. Complete with full sound effects, score and a ladder of high scores.

Rocket Raid (price £9.95) sends you on a mission to raid a heavily guarded Martian fuel depot. You must fly your rocket over mountains and through caverns, avoiding enemy missiles and dodging convoys of deadly fizzers.

Increase your business acumen.

Desk Diary (price £9.95) is an indispensable program that can hold a file of several hundred names, addresses and telephone numbers.

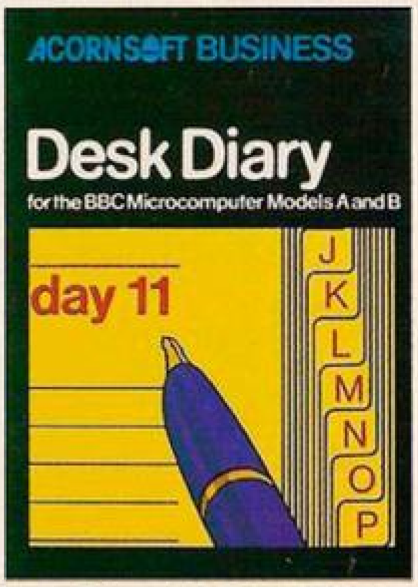
And View, a program that enables your machine, together with a printer, to operate as a fully operational word processor. (The program is in ROM, but can easily be fitted to most BBC Micros by your local dealer.) You can find out more by sending for our free catalogue.



How to get Acornsoft programs.

If you're a credit card holder and would like to buy cassettes of the programs shown in this advertisement, or if you would like to know the address of your nearest stockist, just phone 01-200 0200.

Alternatively, you can buy the cassettes directly by sending off the order form below to: Acornsoft, c/o Vector Marketing, Denington Estate, Wellingborough, Northants NN8 2RL. Also use this form if you would like to receive the current free Acornsoft catalogue.



Please allow 28 days for delivery.

☎ Credit Card Holders. Ring 01-200 0200.

To: Acornsoft, c/o Vector Marketing, Denington Estate, Wellingborough, Northants NN8 2RL.

Please send me the following:–

PROGRAM	PRICE	QUANTITY	TOTAL	(Code Acornsoft use only)
Creative Graphics	£17.45			(SBX01/SBD01)
Word Sequencing	£11.90			(SBE06)
LISP	£24.35			(SBL02/SBD04)
FORTH	£24.35			SBL01/SBD03)
Philosphers Quest	£9.95			(SBG01)
Snapper	£9.95			(SBG04)
Rocket Raid	£9.95			(SBG05)
Desk Diary	£9.95			(SBB01)

TOTAL ______

I enclose PO/cheque payable to Acornsoft Ltd. Or charge my credit card.

Card Number________________

Amex/Diners/Visa/Access (Delete)

Please send me the Acornsoft brochure. ☐

Name________________

Address________________

________________ Postcode________

Signature________________ YC3

Registered No. 1524763 VAT No. 215 8123 85

ACORNSOFT

Your Computer
Subscription Manager
IPC Business Press
Oakfield House
Perrymount Road
Haywards Heath
Sussex RH16 3DH

Your Computer **Lynx competition**

WIN A CAMPUTERS LYNX

A Lynx will be awarded to the winner of the *Your Computer* Camputers competition. To enter the competition, all you have to do is complete the crossword below and finish the sentence "A Lynx would bring out the animal in me because . . ." in 12 words or fewer. All entries must be sent to the *Your Computer* offices by the last working day in March 1983.

Name: ____________________

Address: ____________________



Complete this sentence in 12 words or fewer. "A Lynx would bring out the animal in me because __________

Your Computer
Subscription Manager
IPC Business Press
Oakfield House
Perrymount Road
Haywards Heath
Sussex RH16 3DH

Your Computer **Lynx competition**

ACROSS

- 3, 1 Trace a hope for a snake with anger (6)
- 5 Puzzle to make out (6)
- 9 Use micro to act in the theatre (7)
- 10 Jail store (3, 4)
- 11 One who wrote 10A for a simple TV show, right? (5, 10)
- 12 For X = Y to Z: Gosub 100: Next X (7)
- 15 Relax and rock — basically, the reading will start at the beginning (7)
- 17 It's at the heart of the CPU's start-up (7)
- 19 I see Tim computing too (7)
- 20 Separate from one who goes beneath the surface, before returning, for example (7)
- 21 The President delves in cool in a roomy atmosphere (7)
- 22 Crash — about onto fifty, to the studios (7)
- 23 Let it change the name (5)
- 24 'a scent on' loveliest and die away (9)

DOWN

- 2 10A again (6)
- 4 Initialise a disc and prepare to keep working (3, 2, 5, 3)
- 5 Clear cheque and stir up the Greek's old problem (9, 3, 6)
- 6 Member of the United Nations without weapons? (9)
- 7 Flapping Tom holding a joke (8)
- 8 Tall, about right to drag along (6)
- 13 Learn the majority of 4A when A4 — CHR$ (VAL 100) (8)
- 14 Meaningful words come forth, for example (8)
- 16 Stop the clock for a period away from home (4, 3)
- 18 A strange lot — more of a varied pitch (7)

Your Computer **Lynx competition**

Your Computer
Quadrant House
The Quadrant
Sutton
Surrey SM2 5AS

Affix
Stamp
Here

SUBSCRIPTION ORDER FORM

☐ Please send me 12 issues of *Your Computer*

Cheques should be made payable to IPC Business Press Ltd. Cash with order please.

Name ....

Address ....

....

Signed ....

Date ....

☐ Subscription rate U.K. £8

☐ Overseas £14

Airmail rates can be supplied on application to the Subscription Department

YOUR COMPUTER MARCH 1983

Your Computer **Lynx competition**

RULES:

- The winner of the competition will be the person who enters a correct solution to the crossword and, in the view of the editor, completes the unfinished sentence in the most interesting way.
- The name of the winner will be printed in the May issue of *Your Computer*.
- All entries must arrive at the *Your Computer* offices by the last working day in March 1983.
- Each person may enter the competition only once.
- Entries to the competition cannot be acknowledged.
- No employees of IPC Business Press or their relatives may enter the competition.
- The decision of the editor is final.
- No correspondence on the result of the competition will be entered into.
- IPC Business Press assumes no responsibility or liability for any complaints arising from this competition.

SUBSCRIPTION ORDER FORM

☐ Please send me 12 issues of *Your Computer*

Cheques should be made payable to IPC Business Press Ltd. Cash with order please.

Name ....

Address ....

....

Signed ....

Date ....

☐ Subscription rate U.K. £8

☐ Overseas £14

Airmail rates can be supplied on application to the Subscription Department

YOUR COMPUTER MARCH 1983

DAMS OFFICE EQUIPMENT
Not Simply a Computer Dealer

VIC 20/ COMMODORE 64 IEEE 488 CARTRIDGE

A breakthrough for all VIC/64 users. The DAMS IEEE is a simple, plug-in Cartridge interface which slots into the back of your VIC/64 and links it to disk drives, language packs, printers and other peripherals. Run several VIC/64's. from one disk drive.

£49.95 + VAT.

(Price including VAT. £57.44).



VIC 20 RAM'N ROM BOARD

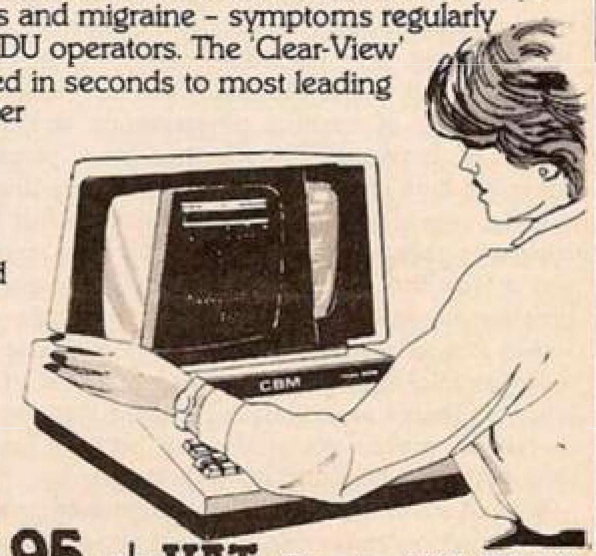
Doubles the memory capacity of your VIC and gives you the facility to fit extra functions (VIC AID, VIC MON etc). Comes complete with specially designed cover.

£22.95 + VAT. (Price inc. VAT. £26.39).

Technical leaflets available on all products.

'CLEAR-VIEW' ANTI-GLARE SCREEN

This exciting new product from DAMS is the answer to eye fatigue, headaches and migraine - symptoms regularly encountered by VDU operators. The 'Clear-View' screen can be fitted in seconds to most leading brands of computer monitors or microcomputer screens, and immediately reduces unwanted glare and reflection to a minimum. Suitable for use with mono or colour displays.



up to 12" **£19.95 + VAT.** (Price inc. VAT. £22.94).
Suitable for Commodore 4032, 8032, etc.

13" to 20" **£24.95 + VAT.** (Price inc. VAT. £28.69).
20" and larger by special order.

VIC AID

Commodore 64 version available on disk or cassette

Vic Aid is a chip which slots easily into the DAMS RAM'N ROM Board, and offers two sets of Utilities in one for the keen programmer:

Programmers Tool Kit
Gives extra commands: Auto, Number, Help, Delete, Change, Trace, Step, Light Pen, Break etc.

Machine Code Monitor
Gives Save, Memory. Display, Load, Verify etc. (similar to TIM on PET).

£19.95 + VAT. (Price inc. VAT. £22.94).

VIC MON

Commodore 64 version available on disk or cassette

Another fine product to enhance the machine - code capabilities of the VIC, VICMON is the ultimate programming aid, incorporating: Assembler, Dissassembler, Fill, Re-Locate, Identify, Printing, Display Status Register, Display Memory with pause facility, Full Screen Assembly Edit, Software re-set from loops, Single step with variable speed etc. Slots into the DAMS RAM'N ROM board or similar.
If similar please state type.

£19.95 + VAT. (Price inc. VAT. £22.94).

DAMS OFFICE EQUIPMENT LTD.
GORES ROAD,
KIRKBY INDUSTRIAL ESTATE,
KIRKBY, NEAR LIVERPOOL. L33 7UA.
TEL: 051-548 7111

CREDIT CARD TELEPHONE ORDERS WELCOME (Normal Office Hours).

DEALER ENQUIRES WELCOME

Send your business card, and receive our dealer 'fact pack' NOW!
12 months parts & labour guarantee on all products.

E& OE

Please send me the following items

I enclose cheque/P.O. OR please debit my:
Access No.
Barclaycard No.
Name
Address
Tel:
(Prices inc. p+p)
YC3.83

YOUR LETTERS

SCHIZOPHRENIA: DIVIDED VIEWS

I was rather surprised at the pompous and totally unhelpful reply to Bradd France in Response Frame in January's issue of *Your Computer*. Coming from a magazine that publishes advertising for a computer known not to be available for months on end, that is, the Spectrum, a high moral tone does not seem entirely appropriate.

What right has Tim Hartnell to assume that someone wanting to stop an auto-run machine-code program must be also wanting to contravene copyright? There have been a couple of occasions when I have unthinkingly made a machine-code program with a bug in it an auto-run version, and then Saved it to be safe. A lot of typing would have been avoided by having an ability to stop execution and rescue the item. Secondly I have found it a very valuable way of learning programming techniques in machine code. I do hope that Tim Hartnell is not proposing to have the copyright laws changed to make even study illegal.

If the user of a stopper program does in fact intend to infringe copyright, then what business is it of yours anyway? However, if you do feel that "it would be highly irresponsible to publish" a program intended to break into machine code then perhaps you would care to explain why you did publish one in the December Software File? Gino Gracin's very useful "list self starter" was just what Mr France needs, but as I imagine that your curiously-mixed morals will prevent you publishing this to let him know then I can only hope that he found it for himself.

While I am at it can I suggest that your contributor to Response Frame sticks to answering questions about computing — which he is evidently competent to deal with. I have in past issues seen some entertaining replies to TV and tape recorder queries.

A Jaques, Urmston, Manchester.

BUG SPOTTER

You only do it to annoy, because you know it teases! All those errors in published machine-code programs. Three recent corrections, which may be helpful to your other readers, are as follows: first, Hopper, January 1983, addresses 16854 to 7 were left out and should be 22 D3 40. 16974 should contain B3, and 16975,6 should read 20 FB.

Second, Snake, February 1983 Software File, addresses 16574 to 16581 omitted, putting all subsequent addresses out by eight bytes. These addresses should contain 01 12 13 11 01 00 18 16.

Third Maze Chase as listed, also February Software File, gives a set of bars but no maze. Address 16564 should contain 00. All the above codes are hexadecimal numbers. I know it is good for us to debug machine-code programs, but this can take longer than entering them.

J R G Nash,
Botley,
Oxfordshire.

RAM WRINKLE

When the BBC Basic conversion board is fitted to an Acorn Atom, it disables the Atom's bus buffers for addresses in the range 4000-7FFF. This is sensible when in BBC mode, as this area of memory is then used for I/O, the utility ROM, and the graphics RAM. But when in Atom Basic mode, this area could otherwise be used by external RAM to extend the text space.

Luckily, a simple modification to the BBC Basic conversion board will enable the bus buffers for this address range when in Atom mode. It involves bending pin 11 of IC14 up so that it no longer makes contact with the socket, then connecting this pin to pin 12 of IC 12.

Readers may also be interested to note that with the extra 2K bytes of RAM provided on the BBC Basic conversion board, the total RAM in the system becomes in the BBC mode:

8K from 0000 to 1FFF
6K (graphics) 4000 to 57FF

and in the Atom mode

1K from 0000 to 03FF
7K from 2000 to 3BFF
6K (graphics) 8000 to 97FF

Mike Lord,
Basildon,
Essex.

FAST SLIDE

Stewart Stallworthy obviously went to a great deal of trouble to prepare the Z-80 Slide Show code — Software File, January 1983. The essence of the job can be done with the single instruction LDir, and roughly three times faster, as follows:

Code	Assembly	Comment
21 A4 9C	LD HL,40100	first byte of saved display, the same as the published example.
11 00 40	LD DE,16384	first byte of display file proper
01 00 1B	LD BC,6912	byte count
ED B0		LDIR block transfer until BC=0
C9	RET	

12 bytes of code, versus Stewart's 48, and relocatable! The whole thing really does operate with astonishing speed; it takes about six milliseconds to execute the whole routine once on my Spectrum. Try alternating between two Saved displays — it is enough to make your eyes water!

Incidentally, I detected a bug in Stewart's listing; address 40029 should contain 239, not 238 as shown. Fortunately it does not matter; the JR points to the last byte of LD HL,nn at 40010 which decodes as LD B,B.

D W Albery
Fleet,
Hampshire.

BUZZING

ZX-81 users may be interested to know that one reason for loading problems may be the close proximity of TV set and tape recorder. Check by running the recorder on play without a cassette or with a blank tape and with the volume turned up high. When placed near a working TV set, particularly at either side, a harsh buzz will be heard. If a ZX-81 set to Load is then connected, a pattern of bright bands reminiscent of correct loading but closer and narrower will be seen even though no program is being played. Previous to this discovery I had to strike a balance between too little volume and too much. Too much volume was really interference from the scan coil in the TV. Now with a cassette player two to three feet distant, I can use full volume and get perfect loading.

A second discovery is that an edge connector with the trade mark UECL has a contact design which I consider gives much more positive contact with the ZX-81 circuit board. I have also carefully removed the thick layer of solder from the ZX-81 contacts. I can now deliberately rock my home-made memory board back and forth without losing memory; previously even a slight vibration could cause a maddening crash.

Could I suggest that computer reviews be aimed rather more towards the user like myself who has little interest in games. For example, a computer without Arc Sine and Arc Cos is an anachronism to me. Accuracy of working can be of interest since 8 figures is sometimes insufficient for one of my interests, astronomical calculations. A point which I have never seen mentioned is the resetting of variables — that is, data to zero — if a program line is altered. This is most frustrating when debugging a program, but with my ZX-81 I can go along happily editing and restarting at the corrected line.

B Manning,
Stakenbridge,
Worcestershire.

1K CHESS

The code presented for the three articles on chess is correct. If you are having problems then I'm afraid an incorrect number has been typed in and you are finding out first-hand the pleasures of machine-code programming.

I did omit to tell you of two Pokes prior to saving the 1K working game which provide the moved King or Queen's pawn. Prior to typing RAND USR 18542 type

POKE 17241,0
POKE 17252,53

These move the King's pawn forward then

RAND USR 18542

STRANGE DISSERTATION

Time is envisaged by some thinkers as particulate. That is to say, time is composed of discrete particles. These particles are known as chronons, and being particles they must have mass. Since they have mass it follows that they must occupy space.

The rate of flow of time is demonstrably the same in all parts of the universe — except when very high speeds are considered — so much is common knowledge.

I am convinced that this state of affairs does not apply to the space in the vicinity of microcomputers and their associated paraphernalia. My theory is that microcomputers interfere with the space-time continuum in such a way that the density per unit area of chronons in the vicinity of these objects is very much reduced: it can be seen that in a volume of space where there are few chronons, the amount or quantity of time will be less than in a normal volume of space.

A few minutes near a microcomputer may be equivalent to an hour or more in a normal atmosphere, so that when your wife/husband/girlfriend/boyfriend calls you away from your computer, and you reply, "five more minutes", is it surprising that an hour or more of normal time passes?

This theory also explains the 28 days phenomenon. For example, it is not widely known that Clive Sinclair is convinced that the whole world is playing an immense practical joke on him — he believes that all his computers were delivered within 28 days. What he is unaware of is that the 28 days were measured in the rarified chronon atmosphere surrounding his computer factory.

Dominic Purdue, North Jesmond, Newcastle-upon-Tyne.

and Save this on to tape or type:

```
POKE 17242,128
POKE 17253,53
```

moves Queen's pawn forward.

These Pokes move Queen's pawn forward then:

```
RAND USR 18542
```

and Save on to tape.

If you give up, but still would like the game, you can probably obtain a 1K chess by either Artic or Sinclair from your local supplier. If in difficulties write to me enclosing £3 and I will return a tape of the playing program.

David Horne,
Crowborough,
Sussex.

CREEPY LIFE

Some errors crept into my ZX-81 life program in the January 1983 issue of *Your Computer*. In the machine-code list, figure 1, the code at location 16603 should read 6,32. Also in the Basic listing, line 135 should read Goto 40.

P J Whittle,
Chobham,
Surrey.

ZX RAND

The Rand statement on the ZX-81 and the ZX Spectrum is very useful. It is used to call a lot of machine-code routines in the form:

```
20 RAND USR 16514
```

However, the Rand statement can be used for a lot more. When Rand is used; the number following the Rand statement is placed in locations 16434 and 16435 — see page 178 in the ZX-81 manual. On the XZ-81 these locations can be used to pass numbers to machine-code routines or for a quick conversion routine.

Suppose you wanted to Poke N into locations 16514 and 16515, normally the program

```
10 REM XX
20 INPUT N
30 POKE 16514,N-INT(N/256)*256
40 POKE 16515,INT(N/256)
```

would be used, using Rand the following could be:

```
10 REM XX
20 INPUT N
30 RAND N
40 POKE 16514,PEEK 16434
50 POKE 16515,PEEK 16435
```

This saves 13 bytes on the original and takes about half the time to execute. One word of warning. Having N=0 will not work as unpredictable results will be put into locations 16434 and 16435. The same technique can be used on the Spectrum but the locations that Randomise sets will need to be looked up.

Finally a four-line program to set RAMtop. The RAM size is held in N that is N=1 for 1K

```
10 RAND 1024*(16+N)
20 POKE 16388,PEEK 16434
30 POKE 16389,PEEK 16435
40 NEW
```

Each line can be entered as a direct command.

Tim Griffith,
Coventry,
Warwickshire. ■

EDITORIAL

WHEN THE finely-worded comparison tables of the micro-makers trawl for new buyers, only the computing-wise slip through the net. They make sure that when they are eventually caught it is because they wanted to be: they know how to read between the lines. The rest of us swim blindly into those grids which compare the features offered by the new wonder micro with its competition. Naturally, only the advertised machine has a tick in every box.

Occasionally we may wonder about the importance of the green plastic securing screws which the table tells us only the touted micro can boast. But usually we swallow claims for speed, memory and resolution hook, line and sinker.

Of course, these claims are rarely untrue, but they are often only relative facts and depend largely on the knowledge of the would-be buyer for correct interpretation. You might not be hugely impressed by a car whose adverts major on the fact that it features a complete internal combustion engine. On the other hand, a total newcomer to computing might be awed by the promise of a silicon-wafer central processor.

Sometimes the glossy brochures can be unhelpfully obscure. Just how many beginners really needed to know that the ZX-81 offered a full 26 For-Next loops?

Against that, facts which are genuinely useful are frequently omitted. The amount of RAM remaining after the operating system and high-resolution graphics have helped themselves is the kind of information that can sway a buying decision.

This is because it is the type of fact that can reduce the 48K Lynx to an 11K machine, and the 32K BBC Micro to an 8K one. The £50 Microdrive promised in the Spectrum adverts seems to offer mass storage at a micro price, but for the last six months there has been no reference to the £30 interface you will need to drive it.

The modern buyer must also be a student of relativity to be able to understand the "high" in high resolution, the "low" in low cost, or the "fast" without which Basic would no longer seem complete.

Although "advanced" in the context of graphics presumably means user-defined, a smattering of semantics comes in handy when trying to decide what "professional" means when applied to a plastic-capped rubber keyboard. Descriptions of sound and colour facilities contain the same sort of ambiguities — ambiguous, at least, for the beginner. One of the solutions to these problems is increased computer literacy. With a buying public as well informed as in the car market, the home-computer manufacturers will be obliged to be even more precise in their publicity machinery. It will also mean that the buyer will recognise which features are common to all micros and which are specific to the one advertised. Being told that Basic is resident in ROM does not have quite the same glamour if you know that this is the rule rather than the exception.

After years of complaints about the misleading claims of motor companies for their cars' petrol consumption, legislation was needed before independently-assessed mileage figures were introduced.

Unless the industry can come up with a set of mutually acceptable standards by which micros can be judged, it may find similar measures forced upon it. ■

How to write for *Your Computer*

We called this magazine *Your Computer* precisely because we welcome your views, tips and hints and even your criticism of machines and software in general. If you would like to see your name in print, whether on a Software File program or a full-blooded article, here is how to go about it. Ideally, all articles should be typed double-spaced on one side only of uniform sheets of paper. If listings can be dumped directly from a printer — you can always use a friend's or user group's — this minimises the risk of error. In a perfect world a cassette would accompany the article. That considerably speeds up the checking process. Not only do you get to air your own discoveries and opinions, but we will even pay you for the privilege. We pay £35 per published page — that's as it appears in the magazine and includes illustrations.

Why not give it a try? You have nothing to lose but your postage.

Editor
TOBY WOLPE
Assistant Editor
MEIRION JONES
Staff Writer
SIMON BEESLEY
Sub-editor
PAUL BOND
Editorial Secretary
LYNN COWLING
Editorial: 01-661 3144

Your Computer, Quadrant House, The Quadrant, Sutton, Surrey SM2 5AS.

Subscriptions: U.K. £8 for 12 issues.

Typesetting by In-Step Ltd, London EC1.
Printed by Riverside Press Ltd, Whitstable, Kent.
Published by IPC Electrical-Electronic Press Ltd, Quadrant House, The Quadrant, Sutton, Surrey SM2 5AS. Tel: 01-661 3500 Telex/grams: 892084 BIPRESG. ISSN 0263-0885

ABC
MEMBER OF THE AUDIT BUREAU OF CIRCULATIONS

Advertisement Manager
PHILIP KIRBY 01-661 3127
Assistant Advertisement Manager
PETER RICE 01-661 8441
Advertisement Executives
BILL ARDLEY 01-661 8484
NIGEL BORRELL 01-661 3127
Midlands Office
KEITH SALT 021-356 4838
Northern Office
RON SOUTHALL 061-872 8861
Advertisement Secretary
JEANETTE MACKRELL
Classified
GILLIAN JOHNSON 01-661 3036
Publishing Director
CHRIS HIPWELL

£99 Creativision is one up on rival computers

COLOUR, SOUND, and 16K for £99 is rapidly becoming an industry standard, but the Creativision goes one better — literally — it has 17K of RAM.

Although the standard Personal Computer unit looks more like a video game than a home micro, the unit contains a 6502 processor as found in the BBC Micro, the Vic and the Oric and is capable of being expanded to 64K RAM. Resolution is 256 by 192 with 16 colours three sound channels and a noise channel. The 12K ROM includes a Microsoft Basic.

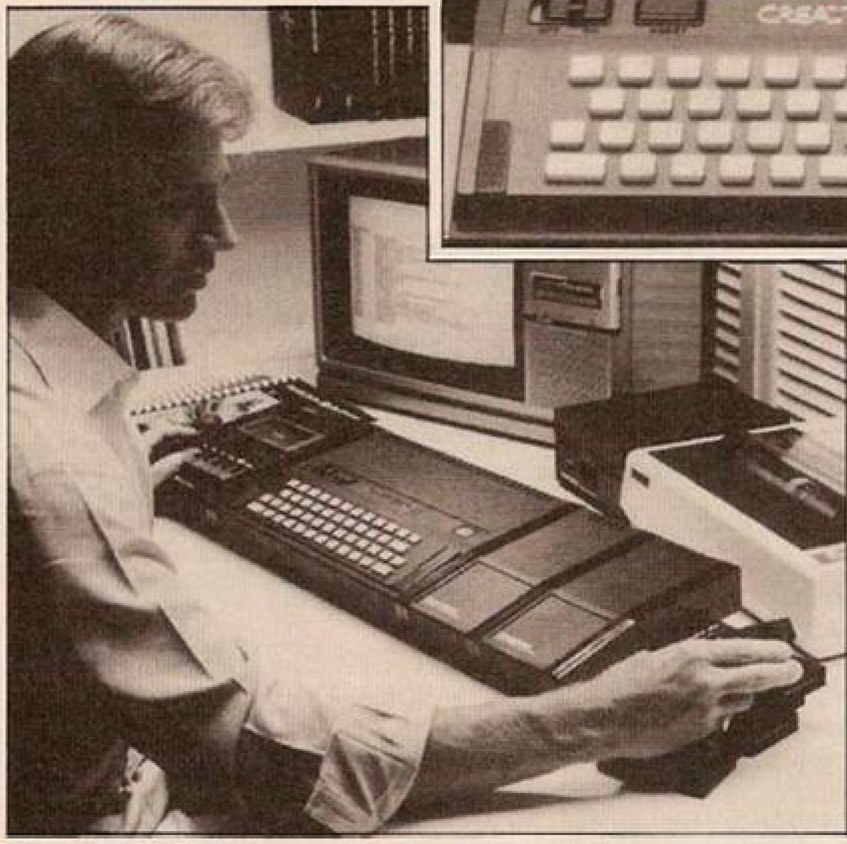
The standard keyboard combines the idiosyncratic layout of the MZ-80K with the feel of a ZX-81 with the cunning innovation of a half-inch gap splitting the board in half so that the two joysticks can be lifted off the front panel.

The optional keyboard — illustrated — is at normal typewriter pitch but it still lacks a full-size spacebar. The screen display is 28 columns of 24 characters each composed from a five-by-seven fount.

A purpose-built cassette recorder, memory expansion units and Centronics and RS-232 interfaces can be plugged into the side of the standard unit. Every 16K of additional memory costs £39 as does each interface.

A Modem and a disc drive will also be available when the machine goes on sale in June, along with printers and acoustic couplers.

ROM cartridges will offer Extended Microsoft Basic and games ranging from old arcade standards such as Sonic Invader and Crazy Chicken to the intriguingly named Police Jump.





Forth of Firth first for BBC

R Q FORTH, written by Roger Q Firth for Level 9 Computing, is a Forth compiler for the BBC Micro. It fits into the model A's 16K, leaving space for about 200 lines of user program. Major features include a full screen editor, 260 predefined Forth words, and an unusual provision for using recursion.

Firth Forth programs run up to 10 times faster than BBC Basic — itself probably the fastest version of Basic on any home micro.

The compiler comes on cassette together with a 70-page manual and costs £15 inclusive. To go with it, Level 9 Computing supplies a Forth toolkit which adds a further 200 new functions and includes such utilities as a 6502 assembler, turtle graphics and five decompiler routines. This too is accompanied by a full manual and costs £10.

YOUR COMPUTER TOP 20

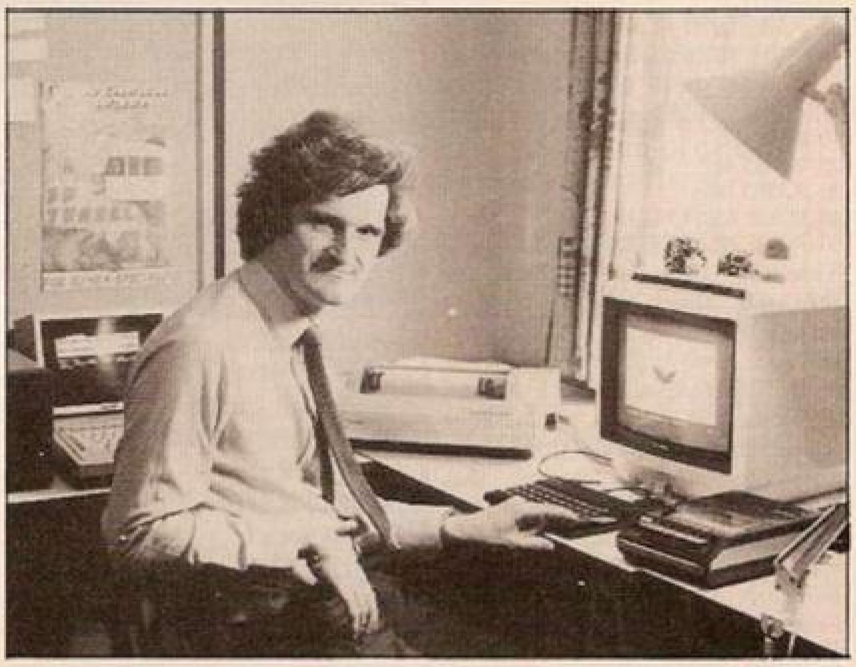
Game	Company	Machine
Hobbit	Melbourne House	Spectrum
Black Crystal	Carnell Software	ZX-81
Spectral Invaders	Bug Byte	Spectrum
Krazy Kong	Software City	Vic-20
Frogger	D J L Software	ZX-81
Moons of Jupiter	Romit	Vic-20
Orbiter	Silversoft	Spectrum
Martian Raiders	Audiogenic	Vic-20
Defender	Atari	Atari
Jelly Monsters	Commodore	Vic-20
Timegate	Quicksilva	Spectrum
Flight Simulation	Psion	ZX-81
Star Raiders	Atari	Atari
Ground Attack	Silversoft	Spectrum
Penetrator	Melbourne House	Spectrum
Gauntlet	Colourmatic	ZX-81
3D Defender	J K Greye	ZX-81
Space Pirates	Bug Byte	BBC
Planetoids	Acornsoft	BBC
Hoppit	Commodore	Vic-20

Light at the end of the Tunnel for Evans the Top 20 games writer

WITH MORE AND MORE of the sales of home computer games concentrated in the hands of a few large software companies it is unusual to find a highly successful company run by a staff of two. Malcolm Evans writes the programs for New Generation Software and, assisted by his wife, also handles production and marketing.

All his games have sold in large numbers and he has even had the distinction of having two hit programs in *Your Computer's* Top Twenty at the same time. 14,000 people have bought his Spectrum program, Escape, and his latest release, 3D Tunnel, looks set to have the same success; already WH Smith has ordered 10,000 copies of the game.

He wrote his programs for the ZX-81 — 3D Defender, 3D Monster Maze and Full Screen Breakout — for J K Greye Software. At the time he was employed by Sperry in Bristol as head of the Microprocessor Applications Group. When Sperry offered him the choice of moving elsewhere or redundancy he decided to strike out on his own with New Generation Software.



3D Tunnel took Malcolm Evans three months to complete. He developed the program on a Sharp MZ-80B before downloading the machine code into the Spectrum.

Like Escape, 3D Tunnel follows an original idea and is not just another version of an arcade favourite. The player has to pass through five stages, destroying bats, rats, toads and spiders before meeting the final obstacle, a London underground train. The game costs £5.95 and will run on both the 16K and 48K Spectrums.



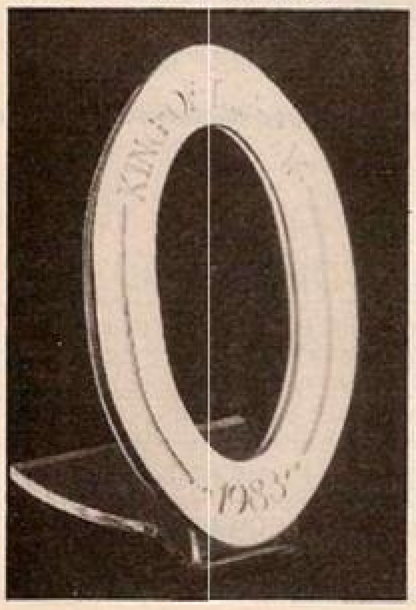
Texas TI-99/2: a new frontier

TEXAS INSTRUMENTS has now released details of the TI-99/2 described in last month's news item. It will be launched in September for around £75. The screen display is monochrome but with the same text format and pixel resolution as the TI-99/4A — that is, 24 by 32 and 192 by 256.

In addition Texas is introducing new low-cost peripherals and software for the TI-99/2 that will also work with the TI-99/4A. These will be on the market in May this year and include a four-colour printer/plotter for £150 and a £120 digital tape drive with a data transfer rate of 8,000 baud.

Most peripherals for the new system will plug into a Hex-bus, a peripheral interface connector, at the back of the machine. At the initial launch 20 programs will be available.

This £700 silver ring — the first prize along with £1500 worth of Acorn hardware and software in the Your Computer/Acornsoft Castle of Riddles competition — is still looking for an owner. Early-birds received their cassettes in the post on the morning of February 16. Acornsoft's managing director claims that the Castle of Riddles adventure game is extremely difficult and that people entering the competition a few weeks after the opening date would probably still be in the running. A winner must be found by March 31.



Tomy the toy-maker's 16-bit micro is not just a Japanese plaything



TOY TOWN has already moved into games machines and is now heading in to home computer land. Tomy, the Japanese toy manufacturer, is launching the 16-bit Grandstand Computer with 16K ROM and 16K RAM for around £170.

The standard machine offers only 19 Basic commands and its main strength lies in its graphics facilities. A built-in character generator allows the user to define a character on an eight-by-eight grid in the lower part of the screen and then position the character with the cursor in the main display.

16 colours are available in a resolution of 256 by 192. Up to four sprites can also be designed and moved by program commands or under joystick control.

Games cartridges can be plugged in and there is provision for further ROM cartridges to extend the Basic and to handle a printer and a floppy disc. The Grandstand Computer has a full 56-key keyboard and will be supplied with two games paddles.

£49 Modem widens net

MICRONET 800, the Prestel database for personal computers, was technically opened on February 21. Networking interfaces are being offered to the first 10,000 subscribers for £49. These include all the hardware and software needed to link the computer up to Prestel via the public telephone system — an acoustic Modem, powerpack, cables and the necessary software.

Adaptors are now ready for the BBC, and Tandy Colour Computer with the necessary software supplied on tape or disc. The Spectrum and Dragon adaptors which should be released in March will be in the form of plug-in cartridges and contain the software in ROM.



Quicksilva fast to spot new software talent

QUICKSILVA IS AMAZED at the number of new programmers out there just waiting to be discovered. A series of advertisements for new talent drew such a good response that it was able to commission new programs for the whole range of home computers.

As a result new Vic and Atari games have now been released along with new titles for the Spectrum and ZX-81. Coming shortly are games for the Dragon, BBC Micro and Lynx.

Quicksilva has also taken on the marketing of the Pixel range of games for the Vic-20 and ZX-81. Production director, Mark Eyles, says that the company seems to be turning into more of a publishing house than a software company.

He added that Quicksilva felt that programmers were very important and should be given the same credit for their programs, in advertisements and on the packaging, as authors receive for their books. Enthusiasts who enjoy a particular program could then look out for the author's next release.

Quicksilva now has distributors all round the world. Mark Eyles jokes that if the company continues to expand at its present rate it would achieve multinational status and "we will all be tax exiles before long."

The Spectrum Desk Console is designed to house a Spectrum and all its peripherals. There is room for a printer, a cassette recorder and the power unit as well as an RS-232 interface and up to two Microdrives. Made from heavy-gauge ABS plastic, it is available from Traffic Technology, PO Box 2, Warminster, Wiltshire, BA12 7QX, for £42.18 inclusive.



Mattel's new age dawns with Aquarius — the 16-colour micro



AT LAST the big American games-machine makers have realised that people prefer to play games on proper computers that they can use for other purposes. Mattel — which makes the Intellivision — is no exception. Not only has the company now launched the Aquarius computer in the States — Britain will have to wait until September — but it has also launched an upgrade kit for the Intellivision.

At less than £100 the 4K, 16-colour Aquarius will be a strong rival to the Timex 2000 in America but the planned £120 British price tag will not frighten Sinclair or Oric. The rubber keyboard does not have a full-size spacebar but a keyboard overlay allows you to make use of a single-key entry option.

The British version will probably have three sound channels and the screen will have 320 by 192 resolution. The Z-80A based machine will run Microsoft Basic.

In America an extra £150 will buy you a tape recorder, thermal printer, joysticks and an expander. A similar package will be available here though the price will be higher.

A built-in RS-232 should encourage Aquarius buyers to consider the Modems and floppy disc drives which Mattel will also be supplying. Mattel claims that the Aquarius will be able to run CP/M.

Meanwhile, anyone who thinks their Intellivision is not too bright will welcome the Intellivision Computer Adaptor. This plug-in keyboard also boosts the machine's memory by 2K and makes Microsoft Extended Basic available along with a six-channel sound generator. The price will be around £80. An £80 piano-style 49-key keyboard incorporating a synthesiser also plugs into the adaptor.

Both the Aquarius and the brighter Intellivisions will be able to run a Logo cartridge, a Basic teaching package, and games based on Scooby-Doo and the Flintstones.

Texas boldly goes to school



COMPUTER literacy is big business in the United States and the new Texas TI-99/2 is aimed squarely at this market. No colour, no sound, but a 16-bit computer whose programs and peripherals are compatible with the established TI-99/4A.

It comes with 4.2K of RAM and 24K ROM and is available in the States for around £60 — for U.K. details see page 31. Expandable to 32K RAM with a rubber keyboard and full-sized spacebar, this is a very real competitor to the American ZX-81, the Timex 1000.

Japan's JR steps in for Panasonic and NEC launches PC-6001

THE JAPANESE have entered the U.S. micro arena. Panasonic's £150 machine boasts 32K of RAM and 16K of ROM, with 2K separate video RAM and 2K character RAM. It has a full-size spacebar and separate cursor control keys. The CPU is a Panasonic chip — the MN-1800A — which is equivalent to the 6802, not a chip that many will be familiar with.

The JR-2000U, which employs its own brand of Microsoft-type Basic, has a choice of eight colours, RGB and TV outputs. Where Panasonic's new baby may be at a disadvantage is in its relatively low resolution of 64 by 48 in the graphics mode.

NEC has also launched its PC-6001 which sells for around £200. It has a rubber keyboard, 16K RAM, 16K ROM, and can be expanded up to 48K. Nine colours are usable and text and graphics can be freely mixed.

PC-6001



Low U.S. price for Spectrum

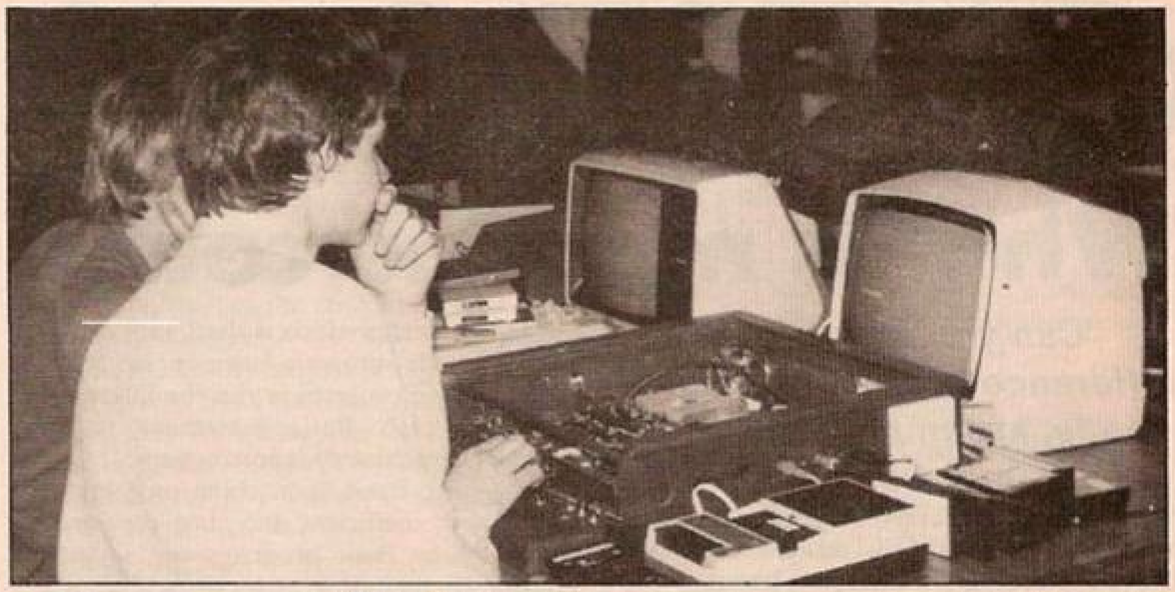
THE TIMEX Sinclair 2000 — alias the American Spectrum — sells over there at around £95 for the 16K version and £125 for 48K. Air vents on the back, a different ROM, a three-voice sound chip and provision for two joysticks are new features, plus a more rugged printer. Do the U.S. prices hint at future U.K. prices?



Spectra Video's new micro — below — costs around £250 and claims to be CP/M compatible. It has 32K RAM and 32K ROM, offers 16 colours, sprite graphics and pixel-addressable colour. RAM can be expanded to 144K ROM to 96K. It has rubber keys, full spacebar and a joystick on the console.



Computer Club is here to encourage you to start your own local computer club or, if one already exists, to join it and become involved. We would like to hear of anything which has made your club a success, or of any projects or programs you are developing.



Nostalgia versus the new microcomputers

Simon Beesley encounters the micro generation gap and a naked Nascom at the West Midlands Amateur Computer Club.

A NEWCOMER TO computing who wandered into one of the West Midlands Amateur Computer Club meetings would probably be struck by the number of machines present which have long since been out of the spotlight. In this respect the West Midlands Club is typical of most computer clubs of several years' standing.

Until recently the Nascom and other kit-based computers such as the UK101 held sway in computer clubland. Although the Nascom was, and is still, available ready-assembled, most owners preferred to build it up from a kit. In the process they needed to develop a greater level of hardware and software expertise than is required if you buy, say, a Vic across the counter. The Nascom is designed for expansion and dedicated owners often end up running CP/M and twin disc drives on their machine.

When the ZX-80 appeared, as the Model T of home computing it introduced a new type of enthusiast to computer clubs. Whereas the kit builder had to be prepared to wield a soldering iron, a Vic or Spectrum owner is unlikely to want to dabble inside the machine.

A fully-fledged Nascom, circuit boards and wiring exposed to view, can be an unnerving sight to the owner of a sealed and packaged mass-produced micro. Many of the new members at computer clubs are now more interested in software than hardware and particularly in games.



Both camps are well represented at the WMACC. The club has been running for five years and has over 150 members. These include 40 Nascom owners as well as a host of Vic, Spectrum and ZX-81 owners. A further 35 members own Pets. As treasurer Malcolm Sparrow explained, the club rarely organises talks or demonstrations but prefers to let members follow their own pursuits.

Naturally interests and activities are diverse. Chris Kitson moved from Nascoms 1 and 2 to a Gemini board. He has written programs to display fast-moving three-dimensional perspective views at 512 by 512 resolution by linking the Gemini up with a graphics-display processor.

In common with most clubs many of the members are interested in exchanging and copying programs. One of the hazards of visiting computer clubs for a magazine is that the visitor is confronted with the magazine's readers. David Hardwick made a vehement but good-humoured attack on computer magazines in general for publishing error-ridden listings. He appeared to be pacified however by the news that *Your Computer* is setting up an even more rigorous checking procedure.

The club meets twice a month on the second and fourth Tuesdays at Elmfield School, Love Lane, Stourbridge. Full membership costs £4 a year and as an unusual facility, members are offered cheap insurance rates on equipment brought along to meetings.

Local society news

London Computer Fair

THE ASSOCIATION of London Computer Clubs promises fun for all the family at its 4th London Computer Fair on April 14-16. After three years at the North London Polytechnic, the Fair has now moved to Central Hall Westminster. The admission fee is £1.50 for adults and 75p for children. Bargain hunters should attend the bring-and-buy sale held on Saturday only.

Gravesend computing

GRAVESEND Computer Club meets on the first and third Tuesday of every month at 7.30pm in the School Room of the Extra Tuition Centre, 39 The Terrace, Gravesend. Kent. For more details ring Steve Janday on 0474-50677.

BBCs in Wales

WALES, first BBC Microcomputer club has been formed in Cardiff. Meetings are held on alternate Wednesdays in the Applied Science Lecture Theatre of University College, Newport Road, Cardiff. Available facilities include four 24in. elevated monitors and full audio-visual equipment. The club has more than 60 members and also runs a Beginner's Corner. Further information from Geoff Barker on Penarth 701023.

The New Mills boom

IN JUST three months the New Mills and District Personal Computer Club has outgrown its existing premises at the New Mills Youth Centre and now meets at New Mills school on the fourth Monday of the month. Members' machines include most makes of home computer. Games enthusiasts are well catered for and competitions are held to develop programming skills. Further details from John Eary on New Mills 43870. ■

Starting out in home computing? First Bytes is for you. Just write to *Your Computer* with any hardware or software problems, no matter how small or simple.

QUESTIONS

What is machine code?

'Can you tell me the difference between machine code, assembly language and Basic?'

AT THE HEART of every microcomputer is a microprocessor, which is really a computer inside the computer. The only language the microprocessor understands is machine code instructions. Each instruction takes up one byte — a set of eight bits of ones or zeros. Since a machine-code program just consists of a list of numbers, writing a program in machine code itself is tedious.

Assemblers are designed to make the programmer's task easier by allowing you to enter mnemonics rather than the numbers themselves. A mnemonic both stands for a machine code instruction and serves to indicate what it does. For example the code 248 in 6502 machine code tells the processor to increase one of its storage locations, the Y register, by one; the mnemonic for this in assembly language is INY.

Disassemblers convert machine code to mnemonics and can be used if you want to examine a machine code program already in the computer.

Whereas assembly and machine code are low level languages Basic is a high level language and needs to be converted to machine code by a Basic interpreter or compiler. Most micros use an interpreter which is itself an 8 or 16K machine code program usually in ROM. When a Basic program is run the interpreter translates each Basic statement to the equivalent machine code instructions.

Converting Basic to machine code line by line is both inefficient and time consuming which is why Basic programs run so much more slowly than programs written directly in machine code.

STRING

THOSE DOLLAR SIGNS which litter Basic programs represent strings. A string is a line of characters which the computer will treat as



Which computer d

'Should I buy a computer with a large memory, and which is the best micro for games?'

IT IS DIFFICULT to give any one feature priority over another without knowing your interests. Obviously, if you are interested in graphics you will rate a high screen resolution above an extensive version of Basic or a powerful sound generator. Like cars, some home computers undoubtedly offer better performance all round but cost proportionately more.

As a beginner it is unlikely that you will need more than 16,000 bytes of memory — 16K RAM — unless you want to store a large amount of data. Most of the best games programs fit into 16K. But figures for the amount of memory a computer offers can be deceptive. An advertised 16K of RAM rarely means that 16K is available for programs.

Every home computer has an operating system. This is the machine code program which — as the term suggests — co-ordinates and runs operations such as printing to the screen, or reading in instructions from the keyboard. Although the operating system is permanently embedded in ROM it needs variables in RAM to keep track of what is happening. Consequently it reserves space in

BEATING THE BUGS

HOW TO CHECK ERRORS

FEW PEOPLE can key in a long program without making any errors. Run the program after an hour or two's hard typing and it invariably crashes. However, you can save yourself a good deal of frustration if you interpret the error messages correctly.

Although the message indicates an error at a particular line usually the fault lies elsewhere in the program. One of the most common error reports occurs when a variable has not been assigned a value. The exact wording of the message varies from computer to computer but it will probably read something like "undefined variable".

The problem here is that you cannot use a variable without having given it a value beforehand. If, for example, a line such as

```
100 LET A=B
```

throws up an error report it means that B has not been set earlier. Look through the listing and check that you have correctly typed in every occurrence of B in the rest of the program.

Another likely message is

```
OUT OF DATA
```

which will be reported at a line with a Read statement in it. Again the error is usually to be found somewhere else in the program. It indicates that the computer has not found enough items in a data statement. Either you have left out an item or you have missed a comma between them.

Syntax errors are not difficult to spot. Sinclair owners are fortunate that the computer checks each line for syntax as it is entered: on other machines it is usually sufficient to retype the line checking for missed colons or spaces. Most Basics will accept a program line without any spaces but there are a few exceptions and, of course, spaces greatly improve the legibility of a listing.

These are just some of the most frequent problems. Other bugs are more subtle and harder to detect. But if you understand the cause of an error message it is usually possible to track down the error without poring over the entire listing line by line.

S AND THINGS

single unit, or string, unless it is told otherwise. If you input

A$="FIRST BYTES"

and then ask it to print A$ it will print

FIRST BYTES

Many useful things can be done with strings, but string manipulation often results in knotty problems for the novice, so here is a quick explanation of string functions and their uses.

LEN(A$) gives the length — number of characters — in a string. This is useful when you need to look at each part of a string in turn by means of a

FOR N=1 TO LEN(A$):NEXT N

loop, or want to add something to the end of the string.

VAL(A$) converts the character representing a number into that number, that is, it converts a string into a numeric variable. This is particularly useful when INKEY$ has been used for input, as INKEY$ always produces a string. Note the VAL of anything other than a number is 0.

```
10 A$=INKEY$:IF A$=""THEN 10
20 A=VAL(A$):IF A<1 THEN 10
```

This rejects anything other than a number from one to nine. ASC(A$) gives the ASCII code of the first character in the string. This can be used to select a group of adjacent characters, such as the numbers one to five.

```
20 A=ASC(A$):IF A<49 OR A>53THEN 10
```

STRING$(N,A) forms a string of length N made up entirely of character A. A may be the ASCII code for a character or the character itself in quotes. Both STRING$(10,65) and STRING$(10,"A") will form a string made up of 10 letter As.

String slicing is carried out by three functions: LEFT$(A$,N) gives the first N characters, RIGHT$(A$,N) gives the last N characters, and MID$(A$,M,N) gives the middle N characters, starting from character number M. If

A$="THIS IS A LONG STRING"

then LEFT$(A$,4)="THIS", RIGHT$ (A$,4) = "RING", and MID$ (A$,11,4) = "LONG". The line

```
FOR N=1 TO LEN(A$):B$ = MID$(A$,N,1):
NEXT N
```

will make B$ = each character of A$ in turn.

When adding strings the second string is always put after the first string.

A$="LONG":B$="STRING":C$=B$+A$

will make C$="STRINGLONG" and not "LONGSTRING". Note that when adding strings you often need to add spaces as well.

C$+A$+" "+B$

gives "LONG STRING".

STR$(A) is used to convert a numeric variable into a string which can then be added like any other string.

A=1:D$=STR$(A)+C$

gives "1 LONG STRING".

To insert into a string it must first be divided into left and right portions at the appropriate point, and the various pieces added back together in the correct order.

```
E$="VERY":F$=LEFT$(D$,2)+
E$+" "+RIGHT$(D$,11)
```

will now give "1 VERY LONG STRING". This type of string manipulation is important in text editing, and also often in sound and graphic functions which are handled as strings.

String searching is carried out by INSTR(N,A$,B$) which will search A$ for B$, starting from character N. If B$ is not found the result is 0, otherwise the position at which B$ starts is returned.

One of the most straightforward uses of INSTR is in checking for valid entries. All valid keys are included in G$, and each INKEY$ value is compared with this.

```
10 G$="ABCDEFG"
20 H$=INKEY$:IF INSTR(1,G$,H$)=1 THEN 10
```

o I need?

RAM and uses it as its own storage area. On the BBC the O/S takes up 3.5K RAM and even the unexpanded ZX-81 has to surrender a hundred bytes to the O/S.

The screen memory also consumes RAM. Most computers map the display on to a section of RAM. Generally there is a trade-off between RAM and resolution: the greater the graphics resolution and the more colours on screen, the less memory available.

A 16K RAMpack for the ZX-81 does indeed offer a full 16K user RAM but the ZX-81 does not provide high-resolution graphics.

The best computers for games at the moment are probably the Atari and the BBC Model B. Features like graphics and sound make some computers more suitable for games programs than others. But just as important a factor is how long the machine has been around and how much software has been developed for it.

Neither the Spectrum nor the Vic can match the BBC or the Atari in their hardware specifications, yet the games for these machines are almost as good and far more varied.

It takes programmers time to discover how to make the best use of a computer — the quality of software for the ZX-81 is still improving.

The Dragon 32 arrived shortly after the Spectrum but there is a flood of programs being produced for the Spectrum and only a trickle, as yet, for the Dragon. One of the reasons for this is that it was easy for the software houses which had been concentrating on the ZX-81 to move on to the Spectrum, since it uses the same processor — Z-80 — and was assured of a large market.

Most home computers are suitable for playing games on, but buyers of new machines should expect to wait some months before the appropriate software appears.

I could do that....

Travel agents' windows often feature a moving advertising display. First Byters can win £15 by sending us a program moving up to 10 characters across and down the screen, starting at the top, passing left to right, feeding into the line below, then scrolling backwards and up to the top. We are looking for simplicity and elegance.

ASCII CODES

EVERY CHARACTER on the keyboard is represented by a code and when the computer stores a character, it stores the code in a single byte. Almost all computers adopt the same set of codes — the ASCII set — pronounced askey, as in Arthur Askey. A notable exception is the ZX-81, which uses its own set of Sinclair codes.

Since one byte can hold a number from 0 to 255 the set can contain up to 256 codes but only those for the keyboard characters are standard. The other codes are usually specific to each computer and could be used for user-defined characters or predefined graphic characters or as control codes.

If you type in and run the program you can see which codes stand for which characters, on your computer. The Basic keyword CHR$ generates a character from its numerical code.

```
10 FOR N=32 TO 255
20 PRINT N, CHR$(N)
30 NEXT N
```

You will notice that the For-Next loop starts at 32. This is because codes 0 to 31 are usually reserved for control characters. When the computer encounters one of these instead of printing a character it carries out an instruction. Control codes can be used to tell the computer to do such things as move the cursor up, clear the screen or change the colour.

Using CHR$ with control codes can be very useful for printing a number of characters to the screen quickly — enabling you to speed up games written in Basic considerably. For example, if 8 is the code for cursor left and 9 the code for cursor down,

PRINT "EE";CHR$(9);CHR$(8);"E"

would print one "E" on top of the other. But it is more useful to insert control codes in a string first, as in:

A$="E"+CHR$(9)+CHR$(8)+"E"

followed by PRINT A$.

This is a rather simple example. To discover what further uses control codes can be put to look them up in the ASCII table in your manual and try experimenting with PRINT and CHR$. ■

THE
ORIC

Even ice-cool Clive Sinclair is feeling the nail-biting tension. Kathleen Peel asks whether the proven virtues of the Spectrum and massive availability of software will be enough to stave off the challenge of the Oric which appears to offer more for £25 less.

EARLY ORICS were plagued with a shaky display. Now the problem has been solved with an Astec modulator but the Oric's picture is still not as good as the Spectrum's.

Both machines exhibit dot-crawl. The Oric has two modes of operation. Text, which allows the user more of the 16K for Basic programs — 12,288 bytes — and Hires — 5,120 bytes. Actual bytes free for Basic programs are calculated by reference to the Oric memory map.

The Spectrum only has 8,846 bytes free but can mix text with Hires without resorting to calling ASCII codes. The Oric picture always retains a black border and this can be a disadvantage.

Ink and Paper

If you wish to provide the effect of a green playing surface, the Spectrum permits a green or any other colour border. Both systems use Ink and Paper commands, although the global effect on Spectrum is only achieved after a CLS command. The colour resolution of the Oric, in Hires, is greater than the Spectrum.

The Oric uses a six-by-eight character cell size which produces noticeably lower character definition on a television display; the Spectrum has a eight-by-eight character cell.



The Spectrum Beep command has always been limited in use within a Basic program, being a single channel. The Oric uses the AY-3-8912 sound chip which provides three channels capable of producing a multitude of different sounds, plus white noise. The oddity of it all is that the Spectrum is rather quiet and the Oric's built-in commands of Zap, Ping, Shoot and Explode are rather noisy.

Both keyboards have a calculator feel. The Spectrum keys are reasonably large and the "feel" can be improved by typing Poke 23609,50. This provides audio indication of a key being pressed. The Oric keys are much smaller and spaced slightly closer together, but at least the Oric has a full-size spacebar. The keyboard plays a more important part in using the Oric as almost all words must be typed in full and therefore, require the user to be accurate in typing commands.

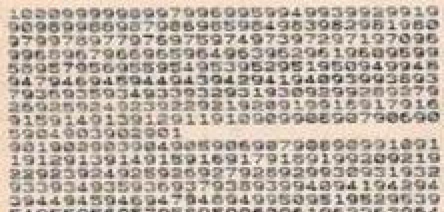
Oric Basic enables the user to use integers



SPEED

Spectrum on left. Oric on right.

Test 1. Array loading.



```
 2 DIM b(1000)
 3 FOR a=1 TO 1000
 4 LET b(1001-a)=a
 5 NEXT a
 6 GO SUB 20: PRINT
 7 LET c=0
 8 FOR a=1 TO 99
 9 IF b(a)>b(a+1) THEN GO SUB
30
10 NEXT a
11 IF c<>0 THEN GO TO 7
12 GO SUB 20
13 STOP
20 FOR a=1 TO 100
21 PRINT b(a);
22 NEXT a
25 RETURN
30 LET d=b(a)
31 LET b(a)=b(a+1)
32 LET b(a+1)=d
33 LET c=1
34 RETURN
```

```
2 DIMB(1000)
3 FORA=1TO1000
4 B(1001-A)=A
5 NEXT
6 GOSUB20:PRINT
7 C=0
8 FORA=1TO99
9 IFB(A)>B(A+1)THEN GOSUB30
10 NEXT
11 IFC<>0THEN GOTO7
12 GOSUB20
13 STOP
20 FORA=1TO100
21 PRINTB(A);
22 NEXT
25 RETURN
30 D=B(A)
31 B(A)=B(A+1)
32 B(A+1)=D
33 C=1
34 RETURN
```

Oric
Time to load array : 15s.
Time to sort array : 300s.
Space occupied by program : 225 bytes
space occupied by variables: 5,036 bytes

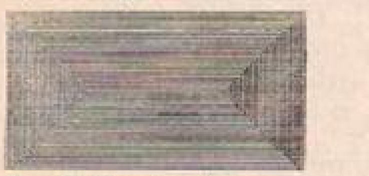
Spectrum
Time to load array : 13s.
Time to sort array 285.6s.
Space occupied by program : 339 bytes
Space occupied by variables : 5,037 bytes

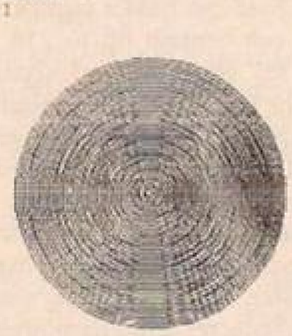
Test 2. Drawing circles.

```
2 FOR a=80 TO 2 STEP -2
3 CIRCLE 120,92,a
4 NEXT a
```

```
1 HIRES:CURSET120,100,1
2 FORA=80TO2STEP-2
3 CIRCLEA,1
4 NEXT
```

Spectrum : 31.2s. **Oric** : 11.3s.
Unfortunately the Oric "circles" are 6.14 wide by 4.87 high.





Test 3. Drawing boxes.

```
3 FOR a=230 TO 80 STEP -4
4 DRAW a,0: DRAW 0,(a-80): DR
AW 2-a,0: DRAW 0,(82-a)
5 NEXT a
```

```
1 HIRES
2 CURSET2,2,1
3 FORA=230TO84STEP-4
4 DRAWA,0,1:DRAW0,(A-80),1:DRAW2-A,0,1:D
RAW0,(82-A),1
5 NEXTA
```

Spectrum : 4.51s. **Oric** : 6.1s.

SHOOT-OUT: V. SPECTRUM



and does mean that the Oric memory requirements are smaller and that more can be packaged into a Basic program. I suggest you look at the program listings carefully; if you are new to home computing, the fact that the Spectrum spaces the text for easy interpretation with an excellent line syntax checker may be crucial. If, however, you have already mastered the fundamentals of programming, then you may prefer the additional potential of the Oric.

Relatively bug-free

It is worth bearing in mind that Spectrum Basic was developed on the ZX-80 and is now relatively bug-free. Even the IBM Personal Computer had some errors. The Oric may suffer in so far as it is a substantial step away from Microtan Basic, Tangerine's old Basic.

The Oric limits the length of a line of Basic code to 77 characters. At 75 characters, the first of three warning Pings is emitted, on the 78th character the line is deleted. There is no line-length limit on the Spectrum.

Oric's editor is worse than the Spectrum's. Edit X brings line X to the bottom of the screen. Typing Control A over characters in the line writes the characters into a duplicate line which on pressing return replaces the original line. Cursor keys delete characters, while typing a character then backspace cursor inserts characters. Unfortunately the amended line is not visible while changes are being made.

Saving and loading

Saving and loading is not without problems. The Spectrum has a printer which is a low-quality, low-cost machine and will produce screen dumps and listings very quickly.

The Oric uses a Centronics interface which operates with Strobe and Acknowledge only. This should allow you to use a wide range of printers but it has not provided satisfactory results with the printer I used.

The Sinclair manuals have been gradually refined and are now very good. The latest Oric manual is a vast improvement on the provisional offerings sent out in December and January but is still not as comprehensive as the Spectrum manual.

Last summer some micro enthusiasts had to wait 20 weeks before the Spectrums they had ordered were delivered. It is early days yet but if demand is high as Oric has stated, I wonder what delivery time scales will be achieved.

CONCLUSIONS

- When comparing machines, it is always assumed that any innovative or exceptional function of one machine shows up as an inadequacy in the other. This is not the case, both of these machines are or will be excellent value for money. If you have £125 to spend, then the Spectrum is perhaps ideal for the beginner or someone who has outgrown his ZX-81 or ZX-80 and wants a machine now. The Oric is likely to be of more use to somebody who already knows a little about computing and who will be able to break the syntax barrier.
- There appear to be many problems still remaining with the Oric's ROM, and perhaps the interface control. It is too early to talk about an extended version of Oric Basic when this particular ROM has not yet been fully debugged. It is a great pity as the potential of the Oric is far greater than that of the Spectrum, and this will obviously appeal to the more technically adventurous micro enthusiast.
- Missing commands include ACS — Arcosine — and ASN — Arcsine. They can be evaluated using Cos Sin and Arctan. Other useful commands not implemented include Copy, Verify, Merge, Flash and Double: these can be simulated using control characters. There are no disc file-handling commands which may mean a new ROM required à la BBC.
- It is important the Oric replaces the EPROMs in the early machines delivered as soon as possible and free of charge. ■

WORLD'S LARGEST LIST OF





Market your own software through us
Write with details

SOFTWARE (All prices include VAT)

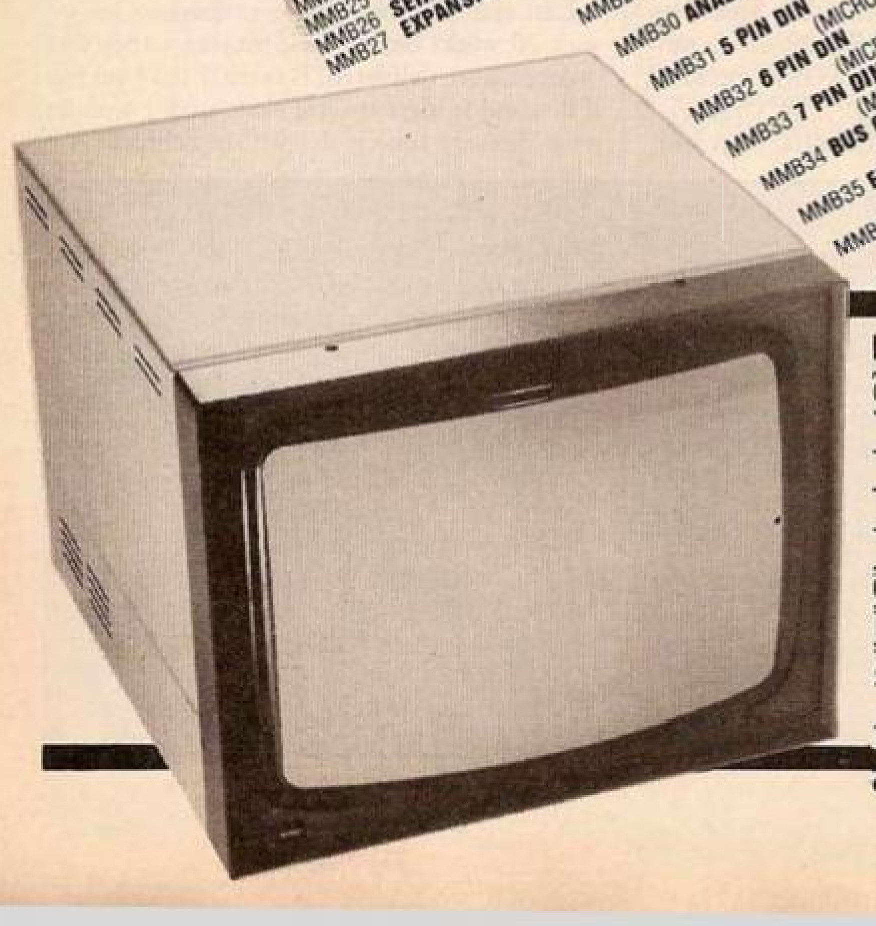
MMS001	OPTIONS TIMETABLE (C)	(A.J. VISION)	£18.40
MMS002	RECORD CHANGER	(A.J. VISION)	£23.00
MMS003	WORD PROCESSOR	(A.J. VISION)	£18.40
MMS004	EDUCATIONAL—I	(GOLEM)	£ 9.25
MMS005	COLOSSAL ADVENTURE	(LEVEL 9)	£11.38
MMS006	ADVENTURE QUEST	(LEVEL 9)	£11.38
MMS007	DUNGEON ADVENTURE	(LEVEL 9)	£11.38
MMS008	STARSPELL	(FISHER MARRIOTT)	£11.50
MMS009	TABLE STAR	(FISHER MARRIOTT)	£11.50
MMS010	EARLY WARNING	(A & J SOFTWARE)	£ 8.90
MMS011	ROADRUNNER	(A & J SOFTWARE)	£ 8.90
MMS012	PLANES	(A & J SOFTWARE)	£ 7.99
MMS013	PHARAOHS TOMB	(A & J SOFTWARE)	£ 7.99
MMS014	FROGGER	(A & J SOFTWARE)	£7.99
MMS015	LUNAR LANDER	(A & J SOFTWARE)	£6.90
MMS016	TOWER OF ALTOS	(A & J SOFTWARE)	£6.90
MMS017	MAZE INVADERS	(PROGRAM POWER)	£5.69
MMS018	FOOTER	(PROGRAM POWER)	£7.99
MMS019	GOMOKO	(PROGRAM POWER)	£4.54
MMS020	MUNCHYMAN	(PROGRAM POWER)	£6.84



HARDWARE (All prices include VAT)

MMB01	BBC MODEL B	(ACORN)	£ 399.00
MMB02	BBC MODEL B + ECONET	(ACORN)	£ 346.00
MMB03	BBC MODEL B + ECON/DISK INT	(ACORN)	£ 516.00
MMB04	BBC MODEL B + DISK INTERFACE	(ACORN)	£ 469.00
MMB05	BBC MODEL A	(ACORN)	£ 299.00
MMB06	BBC MODEL A + ECONET	(ACORN)	£ 346.00
MMB07	BBC DISK DRIVE 100K	(ACORN)	£ 265.00
MMB08	BBC DISK DRIVE 800K	(ACORN)	£ 918.85
MMB09	BBC DISK INTERFACE	(ACORN)	£ 109.25
MMB10	BBC 6502 2nd PROCESSOR	(ACORN)	£ 195.50
MMB11	BBC Z80 2nd PROCESSOR	(ACORN)	£ 195.50
MMB12	TELETEXT RECEIVER	(ACORN)	£ 225.00
MMB13	PRESTEL RECEIVER	(ACORN)	£ 103.50
MMB14	JOYSTICKS (PAIR)	(ACORN)	£ 13.00
MMB15	RGB COLOUR MONITOR M/RES	(MICROVITEC)	£ 287.50
MMB16	RGB COLOUR MONITOR H/RES	(MICROVITEC)	£ 632.50
MMB17	RGB CABLE	(MICRO MAN)	£ 5.75
MMB18	12" GREEN MONITOR	(PRINCE)	£ 99.00
MMB19	12" AMBER MONITOR	(PRINCE)	£ 115.75
MMB20	PLINTH FOR RGB MONITOR	(MICROVITEC)	£ 8.96
MMB21	A TO B UPGRADE (FITTED)	(ACORN)	£ 115.00
MMB22	A TO B UPGRADE (KIT)	(ACORN)	£ 59.80
MMB23	MEMORY UPGRADE (KIT)	(ACORN)	£ 24.72
MMB24	PRINTER I/O (KIT)	(ACORN)	£ 8.74
MMB25	ANALOGUE (KIT)	(ACORN)	£ 8.74
MMB26	SERIAL I/O & RGB (KIT)	(ACORN)	£ 11.79
MMB27	EXPANSION BUS (KIT)	(ACORN)	£ 6.84
MMB28	PARALLEL CABLE ASSEMBLED	(MICRO MAN)	£15.00
MMB29	USER PORT CONNECTOR/CABLE	(MICRO MAN)	£2.30
MMB30	ANALOGUE PLUG & CABLE	(MICRO MAN)	£2.58
MMB31	5 PIN DIN	(MICRO MAN)	£0.69
MMB32	6 PIN DIN	(MICRO MAN)	£0.69
MMB33	7 PIN DIN	(MICRO MAN)	£0.69
MMB34	BUS CONNECTOR	(MICRO MAN)	£4.03
MMB35	EPSON MX80 FT///	(EPSON)	£373.75
MMB36	EPSON MX100	(EPSON)	£488.75
MMB37	SEIKOSHA GP100		£215.00

MMB38	SMITH CORONA D/WHEEL	(SMITH COR)	£ 454.25
MMB39	SPARK JET PRINTER	(ACORN)	£ 419.75
MMB40	TEC STARWRITER	(TEC)	£1285.00
MMB41	5¼" DISKS (10)		£ 22.43
MMB42	COMPUTER CASSETTE TAPES		£ 1.00
MMB43	COMPUTER DUST COVER	(MICRO MAN)	£ 5.74
MMB44	DISK DUST COVER	(MICRO MAN)	£ 5.74
MMB45	CASSETTE RECORDER		£ 29.00
MMB46	FLOWCHART STENCIL		£ 4.02
MMB47	DISK LIBRARY CASE		£ 2.87
MMB48	PAPER LISTING BINDER	(ACCO)	£ 2.87
MMB49	PAPER 9½" • 11" (2000)		£ 14.95
MMB50	GRAPHICS TABLET (CASS'E)		£ 86.25
MMB51	GRAPHICS TABLET (DISK)		£ 143.75
MMB52	LIGHT PEN	(MICRO MAN)	£ 34.50
MMB53	A/D CONVERTOR	(MICRO MAN)	£ 36.23
MMB54	128 K RAM PACK	(MICRO MAN)	£ 343.85
MMB55	COOLING FAN	(MICRO MAN)	£ 38.24
MMB56	DISK DRIVE S.S.40 TRACK	(MICRO MAN)	£ 228.85
MMB57	DISK DRIVE D.S.80 TRACK	(TEAC)	£ 396.75
MMB58	DISK DRIVE 2"D.S.80 TRACK	(TEAC)	£ 711.85
MMB59	2 DRIVE CABLE FOR ABOVE	(TEAC)	£ 17.25
MMB60	APL FOR BBC COMP (BOOK)		£ 8.95
MMB61	30 PROGS FOR BBC (BOOK)		£ 4.95
MMB62	PROG THE 6502 (BOOK)		£ 10.75
MMB63	6502 APPLICATIONS (BOOK)		£ 10.75
MMB64	BBC MICRO REVEALED (BOOK)		£ 7.95
MMB65	LET BBC TEACH (BOOK)		£ 6.45
MMB66	30 HOUR BASIC (BOOK)		£ 5.95
MMB67	Z80 PROC WITH DISK DRIVE	(TORCH)	£1144.25





MICRO MANAGEMENT ORDER FORM

CODE	ITEM	QTY	AT £	AT p	COST £	COST p
CREDIT CARD No		SUB TOTAL				
NAME	BARCLAY/ACCESS	POST & PACKING				
ADDRESS		TOTAL				

BBC MICROS ACCESSORIES

Overseas dealers and distributors enquiries welcomed. Exports a speciality (p&p—Europe 50% extra, Rest of World 75% extra)

Item		Supplier	Price
MMS039	ELDORADO GOLD	(PROGRAM POWER)	£ 6.84
MMS040	LASER COMMAND	(PROGRAM POWER)	£ 7.99
MMS041	ASTRO NAVIGATOR	(PROGRAM POWER)	£ 5.69
MMS042	MICRO BUDGET	(PROGRAM POWER)	£ 7.99
MMS043	FILER	(PROGRAM POWER)	£10.29
MMS044	CONSTELLATION	(CSL MICRODATA)	£ 6.84
MMS045	BEEBTAPE	(BUG-BYTE)	£ 4.60
MMS046	MICRODERBY	(BUG-BYTE)	£ 5.50
MMS047	SPACE PIRATES	(BUG-BYTE)	£ 8.00
MMS048	CHESS		£ 8.00
MMS049	HUMIDITY & TEMPERATURE	(CHRIS HALL ENG)	£24.00
MMS050	CLOCK/CALENDAR	(CHRIS HALL ENG)	£35.50
MMS051	ILLUMINATION	(CHRIS HALL ENG)	£35.50
MMS052	TEMPERATURE	(CHRIS HALL ENG)	

Item		Supplier	Price
MMS071	FORTH	(LEVEL 9)	£17.25
MMS073	HITCH-HIKER	(COMPUTER CONCEPTS)	£6.67
MMS074	SPACEHAWKS	(COMPUTER CONCEPTS)	£8.97
MMS075	ASTEROID BELT	(COMPUTER CONCEPTS)	£8.97
MMS076	CHESS	(GEM SOFTWARE)	£11.50
MMS077	ANGLEZUP	(GEM SOFTWARE)	£ 6.88
MMS078	L TRAP	(GEM SOFTWARE)	£ 6.88
MMS079	TAKE OFF	(GEM SOFTWARE)	£ 5.73
MMS080	GRAPH CAPERS	(GEM SOFTWARE)	£ 6.88
MMS081	MONTE CARLO	(BUG-BYTE)	£ 6.88
MMS082	SPACE WARP	(BUG-BYTE)	£ 9.00
MMS083	GOLF	(BUG-BYTE)	£ 5.50
MMS084	DRAGON QUEST	(BUG-BYTE)	£11.50
MMS085	AIRLIFT	(BUG-BYTE)	£ 5.50
MMS086	POLARIS	(ACORNSOFT)	£ 5.50
MMS089	CUBE MASTER	(ACORNSOFT)	£ 9.95
MMS090	GRAPHS & CHARTS (BOOK)	(BBC)	£ 7.50
MMS091	HOME FINANCE	(BBC)	£10.00
MMS092	EARLY LEARNING	(BBC)	£10.00
MMS093	MUSIC	(BBC)	£10.00
MMS094	THE COMPUTER PROG VOL 1	(BBC)	£10.00
MMS095	THE COMPUTER PROG VOL 2	(BBC)	£10.00
MMS096	PAINTING	(BBC)	£10.00
MMS097	DRAWING	(BBC)	£10.00
MMS098	GAMES OF STRATEGY	(BBC)	£10.00
MMS099	FUN GAMES	(BBC)	£10.00
MMS100	THE COMPUTER BOOK		£10.00





Item		Supplier	Price
MMS101	SALES LEDGER DISK	(MICRO MAN)	£57.44
MMS102	PURCHASE LEDGER DISK	(MICRO MAN)	£57.44
MMS103	FILE IT DISK	(MICRO MAN)	£22.94
MMS104	MAILING LIST DISK	(MICRO MAN)	£11.44

Item		Supplier	Price
MMS021	MASTERMIND	(PROGRAM POWER)	£4.54
MMS022	SPACE MAZE	(PROGRAM POWER)	£6.84
MMS023	COWBOY SHOOTOUT	(PROGRAM POWER)	£6.84
MMS024	ALIEN DESTROYER	(PROGRAM POWER)	£7.99
MMS025	MARTIANS	(PROGRAM POWER)	£6.84
MMS026	SWOOP	(PROGRAM POWER)	£7.99
MMS027	SEEK	(PROGRAM POWER)	£6.84
MMS028	GALACTIC COMMANDER	(PROGRAM POWER)	£7.99
MMS029	CAT & MOUSE	(PROGRAM POWER)	£5.69
MMS030	ZOMBIES	(PROGRAM POWER)	£4.54
MMS031	STARTREK	(PROGRAM POWER)	£5.69
MMS032	REVERSI 1	(PROGRAM POWER)	£5.69
MMS033	CHESS	(PROGRAM POWER)	£7.99
MMS034	WORLD GEOGRAPHY	(PROGRAM POWER)	£6.84
MMS035	JUNIOR MATHS	(PROGRAM POWER)	£ 6.84
MMS036	DISASSEMBLER	(PROGRAM POWER)	£ 6.84
MMS037	TIMETREK	(PROGRAM POWER)	£ 7.99
MMS038	ADVENTURE	(PROGRAM POWER)	£ 7.99

Local Authorities and Government Departments. Orders welcomed. Educational Seminars given.

Item		Supplier	Price
MMS053	ARCADIANS	(ACORNSOFT)	£ 9.95
MMS054	SNAPPER	(ACORNSOFT)	£ 9.95
MMS055	METEORS	(ACORNSOFT)	£ 9.95
MMS056	CREATIVE GRAPHICS	(ACORNSOFT)	£ 9.95
MMS057	TREE OF KNOWLEDGE	(ACORNSOFT)	£ 9.95
MMS058	BUSINESS GAMES	(ACORNSOFT)	£ 9.95
MMS059	PEEKO-COMPUTER	(ACORNSOFT)	£ 9.95
MMS060	ALGEBRAIC MANIPULATION	(ACORNSOFT)	£ 9.95
MMS061	MONSTERS	(ACORNSOFT)	£ 9.95
MMS062	PLANETOID	(ACORNSOFT)	£ 9.95
MMS063	ARCADE ACTION	(ACORNSOFT)	£11.90
MMS064	DESK DIARY	(ACORNSOFT)	£ 9.95
MMS065	PHILOSOPHERS QUEST	(ACORNSOFT)	£ 9.95
MMS066	LISP	(ACORNSOFT)	£16.85
MMS067	GRAPHS & CHARTS	(ACORNSOFT)	£ 9.95
MMS068	CREATIVE GRAPHICS (BOOK)	(ACORNSOFT)	£ 7.50
MMS069	LOGO II	(COMPUTER CONCEPTS)	£11.50
MMS070	FRUIT MACHINE	(BUG-BYTE)	£ 5.50

ECONET? ASK US

Mail or telephone order
Barclaycard or Access
Credit Card accepted

Access | BARCLAYCARD VISA

Only defective or faulty goods may be returned.

MICRO MANAGEMENT

SPECIAL OFFER
Post and Packing £1
on all items
Applies to orders placed in March '83 only

Micro Management 32 Princes Street, Ipswich, Suffolk. Telephone: (0473) 59181

TANDY'S NEW four-pen Colour Graphic Printer could have the same dramatic effect on printing as the change from black and white to colour screen displays has had on computing. It is a direct descendent of the CE-150 2.25in. colour printer produced by Sharp for the PC-1500.

The printer, complete with RS-232 and Centronics interfaces, costs £149 including VAT but not including any connecting cables. It comes with a power supply, operation manual, three black pens, one each of blue, green and red, and a roll of plain paper 4.5in. wide and 180ft. long. The machine is a healthy 8.5in. square by 3in. high and weighs 1.75lb. It is coloured silver-grey, with a black top cover which is raised to gain access to the pens and their holders.

The printer can print either 80 or 40 characters per line. The ASCII character set from code 32 to code 127 is implemented, although unfortunately there is no pound sign. A switch marked special characters provides for Japanese script.

The characters are not produced by a dot matrix or burnt into aluminised paper. In either case, present technology would not permit 80 characters within a space of a little over 3.75in. The characters are formed in the machine's internal ROM and written on to the paper using ink pens. The effect is similar to high-quality type-written text. Except for the lack of proportional spacing of characters, and paper width, the performance is as good as many professional printers.

The printer has two modes of operation, text and graphics. The Graphics mode permits character size to be varied from 80 characters per line to one character per line, in 63 steps retained on return to text mode. Characters can also be rotated in 90° steps. Also available is the facility to draw 15 different types of dashed line. Colour can be changed and a return to text initiated with very simple commands.

Axes are specified in terms of X or Y with a defined step and interval. The step is a multiple of 0.008in. between 1 and 999, positive and negative, and the interval, the number of repetitions of the step, is between 1 and 255.

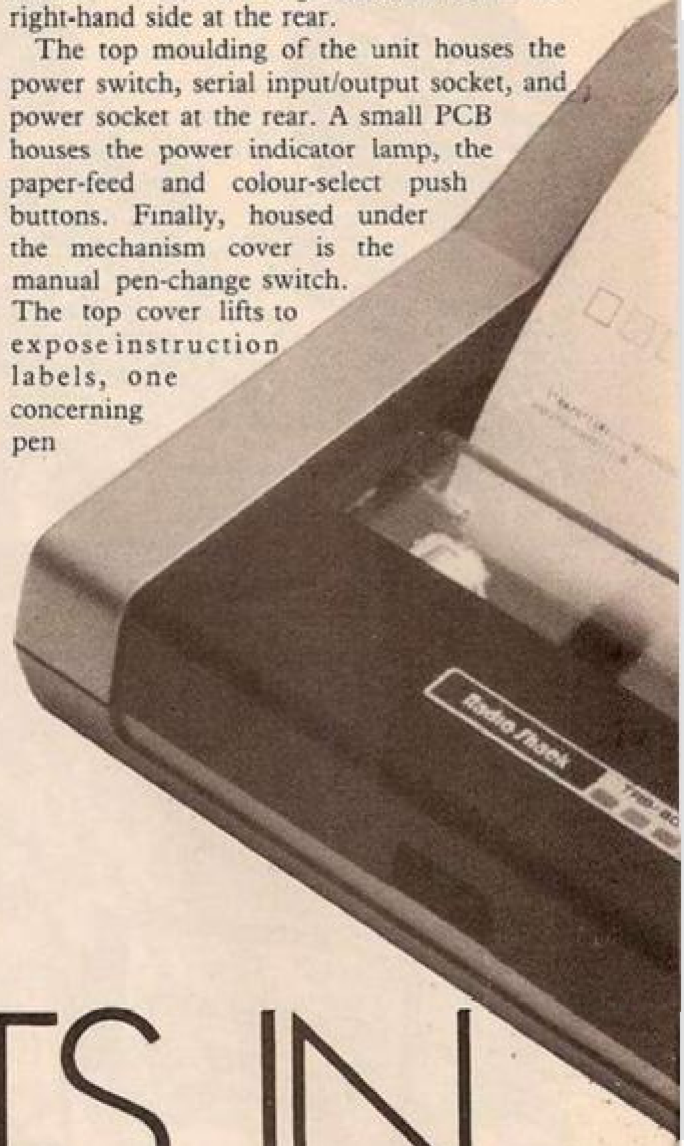
The effective X-axis resolution of 480 steps and equivalent vertical resolution draws convincing circles, without annoying steps on the edge.

The printing speed is a slow 12 characters per second. At present screen dumps of graphics are not possible.

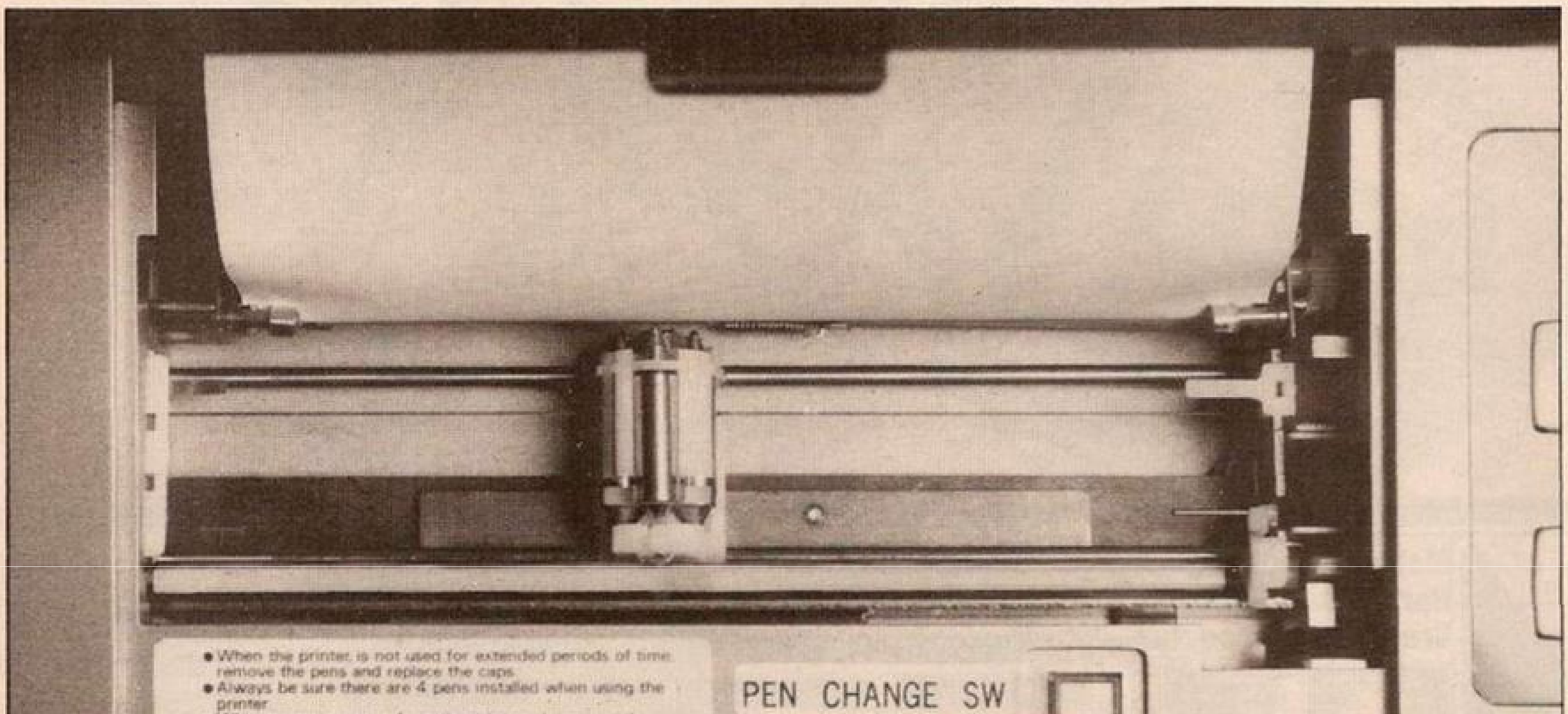
The machine is opened by undoing five screws in the base and releasing four locking tabs to release the top moulding. The base holds the print and feed mechanism at the front. The paper drive is friction-fed by a full-length rubber compound roller and side pressure rollers which also prick the edge of the paper at 0.156in. steps. This gives the effect of tractor drive and has the advantage of providing the Y axis with a quoted accuracy of one percent coupled, with a repetition accuracy of 0.008in.

The PCB is screened from interference and the major integrated circuit components are encased in a screened box shaped around the parallel input/output socket — very professional. There is a large heat sink down the right-hand side at the rear.

The top moulding of the unit houses the power switch, serial input/output socket, and power socket at the rear. A small PCB houses the power indicator lamp, the paper-feed and colour-select push buttons. Finally, housed under the mechanism cover is the manual pen-change switch. The top cover lifts to expose instruction labels, one concerning pen



CGP-115 LISTS IN



REVIEW



If your listings are listless and your printouts are plain, the CGP-115 could be what you are looking for. Kathleen Peel checks it out.

COLOUR

replacement and the other noting how to look after your printer.

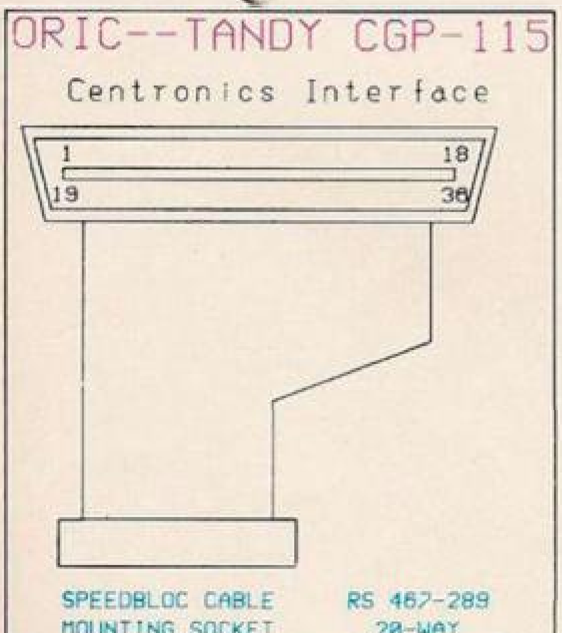
The 50-page manual is well laid out and clear, but there are some omissions. The appendices provide some Basic programs which produce pie charts, sine and cosine curves.

It is surprising that there is no indication of the connections on the four-way DIN socket masquerading as an RS-232 interface. Only pins 2, 3 and 4 are wired. Table 1 gives the connections. The serial interface operates at 600 baud with no parity and two stop bits.

The parallel interface is via a Centronics-type plug but the only connections used are busy — Pin 11, strobe — Pin 1 acknowledge — Pin 10 and the data lines.

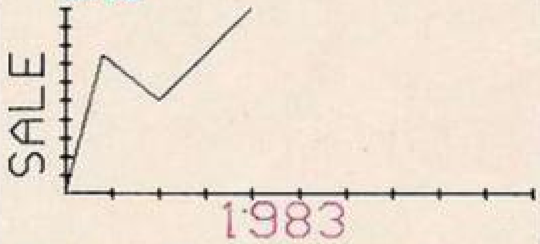
Loading the paper was initially a bit of a problem. A protrusion in the centre prevented the paper from being entered into its loading slot completely, and so take up, by pressing the paper-feed button, could not take place. The answer was to cut a strip of paper 6in. long by 1in. wide and load this into the slot close to one edge, such that it could be fed through by hand. The strip was then slid across into a central position and the full paper width loaded over the top of the strip. As soon as take up was established the strip was removed. I only used this procedure twice as, whatever the obstruction was, it disappeared. Loading the pens was straightforward if a little fiddly. Neither operation is likely to be required very often.

(continued on page 48)



Above: sample Oric/CGP-115 printout.

```
30 LPRINT"R80,-200":REM MAKE ROOM
40 LPRINT"I":REM
50 LPRINT"X0,10,10:REM VERT AXIS
60 LPRINT"HX1,25,10":REM HORIZ AXIS
70 LPRINT"S2":REM CHAR SIZE
75 LPRINT"C3":REM IN RED
80 LPRINT"Q3":REM WRITE LEFT SIDE
90 LPRINT"M-10,10:REM POS PEN
92 LPRINT"PSALE":REM WRITE VERT
94 LPRINT"M10,-40":REM POS PEN
96 LPRINT"Q0":REM WRITE RIGHT WAY
97 LPRINT"C2":REM IN GREEN
98 LPRINT"P    1983":REM TITLE
150 LPRINT"C1"
170 LPRINT"M0,0"
190 LPRINT"D20,75"
200 LPRINT"D50,50"
210 LPRINT"D100,100"
250 LPRINT"C0"
259 LPRINT"S0"
260 LPRINT14,C0
261 FORX=1TO8:LPRINTL0:NEXTX
262 LLIST
264 END
```



Above: typical 80-character printout.

Pin	Function
1	Not connected
2	Busy
3	Earth
4	Data

Table 1. Four-pin socket terminations.

	Printout	
	Length/£	Sq. ft./£
Sinclair	27.2	9.1
Amber	129.4	24.3
CGP-115	112.8	42.3

Table 3. Paper usage running costs.

```
!"#$%&'()*+,-./0123456789:;<=>?@ABCDEFG
HIJKLMNOPQRSTUVWXYZ[\]^_`abcdefghijklmno
pqrstuvwxyz{¦}~█
```

Auto-test character set.

```
10 REM LINE SAMPLE PROGRAM
20 PRINT,CHR$(18)
30PRINT,"L3"
40PRINT,"J480,0"
50PRINT,"A"
60 END
```

Sample BBC/CGP-115 printout.


ORIC-1
ORIC-1™
TIMELESS TECHNOLOGY FROM ORIC PRODUCTS INTERNATIONAL

The Computer Challenge

16 colours professional keyboard full graphics real sound

FREE FORTH with every 48K model.

- Superb styling
- Choice of 16K RAM or massive 48K RAM
- Ergonomic keyboard with 57 moving keys
- 28 rows x 40 characters high resolution
- Teletext/viewdata compatable graphics
- 6 octaves of real sound plus Hi-Fi output
- Centronics printer interface and cassette port
- Comprehensive user manual

THE REAL COMPUTER SYSTEM FOR £99.95 incl VAT

OPTIONAL MODEM OFFERS COMPUTER PHONE LINK FOR:
● ELECTRONIC MAIL ● TELESOFTWARE ● PRESTEL

COMING SOON, TO COMPLETE YOUR SYSTEM: ORIC MICRO-DRIVE DISCS & SPEED PRINTER

FOR HOME: The ORIC-1 is the professional alternative for home computing. Superbly styled, the 57 key layout is based upon computers costing many times more than the ORIC, and will help the whole family to learn and understand computing, right from day one. The ORIC incorporates an improved version of Basic for ease of programming and use. For the enthusiasts the computer has laser zaps, explosions, etc. pre-programmed for games use, with Hi-Fi output for incredible effect. The communications Modem will allow 'Telesoftware', message sending, and Prestel use.

FOR BUSINESS: The ORIC-1 is the answer to many day to day problems. Software is becoming available for payroll, accounts, stock-control, and many more systems to help your day to day business organising and control. In addition, the ORIC COMMUNICATIONS MODEM will allow you to access up to 200,000 pages of Prestel information, to send and receive 'electronic mail', to book hotels, and flights (and pay for them) and to look at the latest stock-market and share indexes.

In short the ORIC-1 is a must for all businesses large or small.

HOW TO ORDER YOUR ORIC-1: By phone: Just ring our telesales number Ascot (0990) 27641.

By post: You can pay by cheque, postal order ACCESS – BARCLAYCARD – AMEX – DINERS. (Please allow 28 days for delivery).

Money back if not satisfied.

ORIC-1 The Real Computer System

ORIC PRODUCTS INTERNATIONAL LTD Coworth Park Mansion, Coworth Park, London Road, Sunninghill, Ascot, Berks SL5 7SE

Item	Qty	Price Inc VAT	Total
ORIC-1 16K RAM		£ 99.95	
ORIC-1 48K RAM		£169.95	
ORIC Communications Modem		£ 79.95	
Postage and Packing			£ 5.95
		TOTAL £	

*Please delete/complete as applicable.
*I enclose a cheque/P.O. payable to: ORIC PRODUCTS INTERNATIONAL LIMITED for £

Please charge my Access, Barclaycard Amex, Diners Club account no.

Name

Address

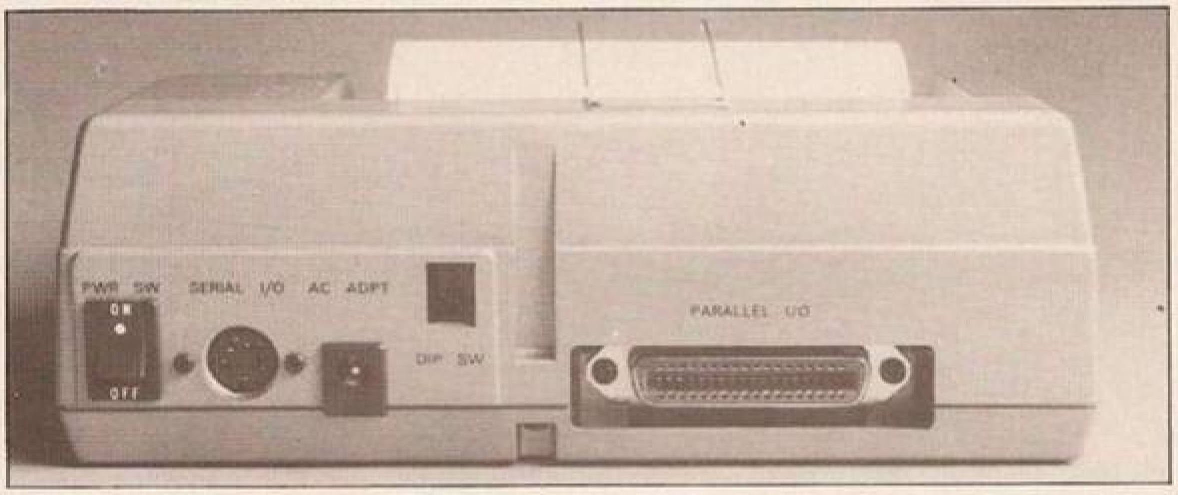
If you require a brochure please tick ☐

YC3

(continued from page 45)

When the printer is switched on, the pen carrier traverses to the left-hand edge and rotates the pens to ensure that holder number one is in the top working position. The printer then draws four boxes produced sequentially by the pens in holders 1, 2, 3 and 4. This is to ensure that the user is aware of any dried-up pens.

Pressing the paper-feed button at switch on sets in motion a self-test procedure that also prints the character set in the four loaded pen colours.



CONCLUSIONS

- Tandy's new printer will transform data presentation and allow the computer to interpret results fully, for ease of reading, varying colour, indentation, and print size as necessary.
- The graphics capability provides for considerably better resolution that available to the majority of micros. The lack of a screen-dump facility is likely to be temporary as users will soon develop software to produce screen dumps in colour.
- This high-quality printer can only be faulted on paper width, and slow speed which may make it unsuitable for word processing.

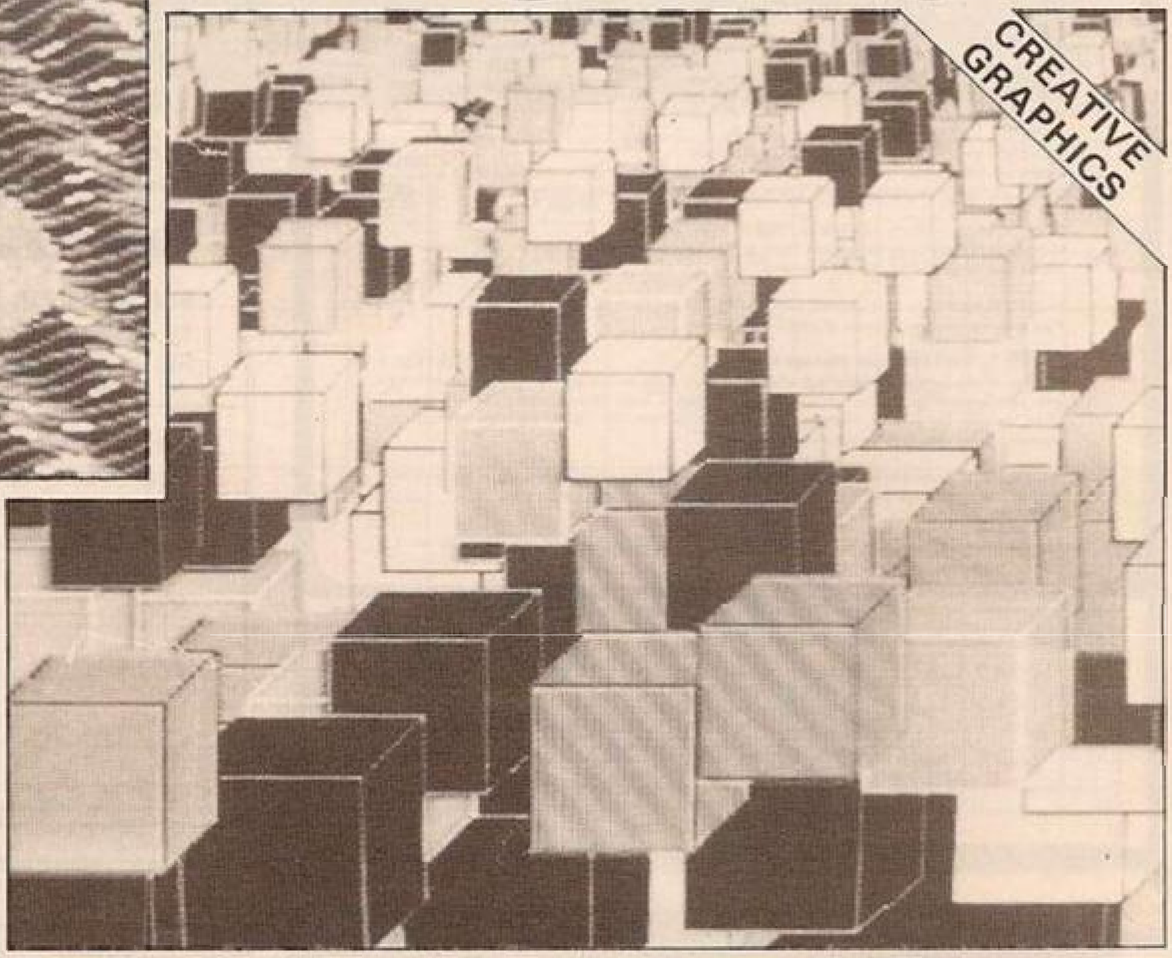
Table 2. Comparison of machines.

		Characters		Paper			Printer Size in.	Basic Cost £	Accessories		
	Colours	line	sec	Type	Width in.	Length ft.			Paper	Rib-bons	life
Sinclair Printer	1	32	50	Metal-ised	4	65	5.5 × 2.9 × 1.9	59.95	11.95 for 5		
Amber 2400	1	24	17	Plain	2.25	88	6.3 × 6.3 × 3.1	89.70	3.40 for 5	2.00 Ribbon	3 × 88ft. rolls
Tandy CGP-115	4	80 to 1in. 63 steps	12	Plain	4.5	150	8.4 × 8.6 × 3	149	3.99 for 3	1.69 for 3 pens	825ft. each pen



If you are all at sea when it comes to choosing programs for your BBC Micro don't gamble — consult Peter Connor's software guide.

BBC SOFT



SOFTWARE FOR the BBC Micro is still pouring down like invading aliens in a video game. Most of it is improving rapidly in presentation, if not originality. Nearly all the games reviewed here have good graphics and sound, and nearly all are the close relatives of a standard arcade game. Like racehorses, arcade games produce many offspring; "by Defender out of Invaders". Unfortunately not all of these games are thoroughbreds.

Superior Software has produced several games, all based on old favourites. The most interesting on offer is Centipede, apparently the only available version of this popular game. You have to try and destroy a fast-moving and very unfriendly centipede which snakes down from the top of the screen. There are other hostile creepy-crawlies, including a spider which menacingly bounces up and down above or on you. Visually this game compares well with the arcade version, being colourful and clear. Unfortunately, it is not possible to fire as rapidly and this can lead to many an untimely death.

Invaders and Galaxians are also produced by Superior Software. These two games, as their names suggest, are standard issue. Both, though, are well-produced, with colourful graphics, responsive controls and the usual bunch of extra-terrestrials.

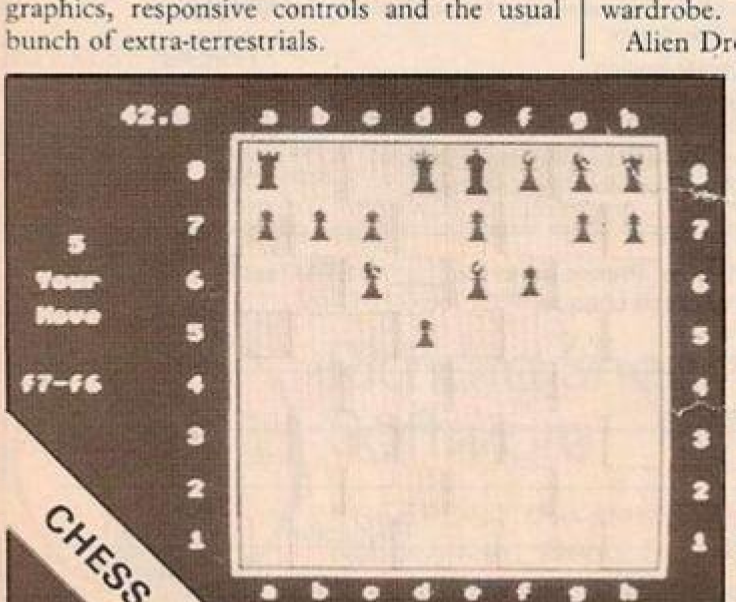
Space Fighter, from the same company, is advertised as a mixture of Defender and Scramble. However, it is not as exciting or as complex as either of these games. There is a curious effect to the display; you seem to be underwater spearing fish rather than blasting baryons and mutants in the lonely sky.

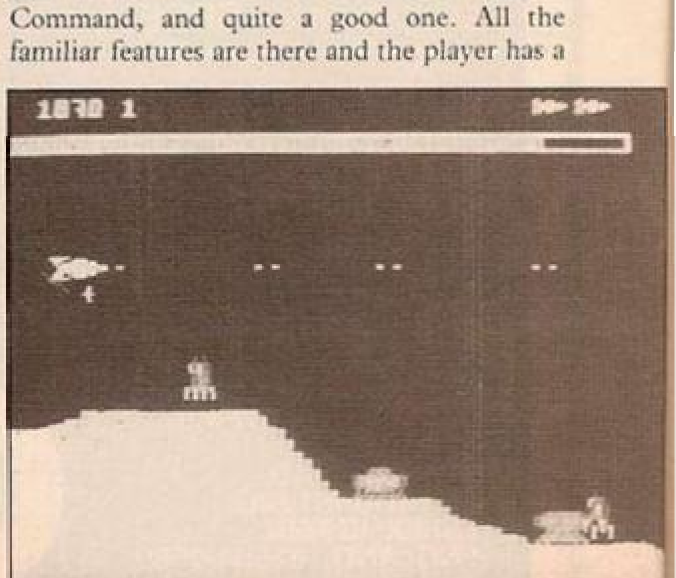
Alien Dropout, again, from Superior Software, has nothing to do with spaced-out hippies. Instead, in another variation of the Invaders and Galaxians theme, you are attacked by killer moths. Do not be fooled by their placid purple appearance — these moths are out to get more than the clothes in your wardrobe.

Alien Dropout is not as fast or as furious as Invaders or Galaxians, but it does have a certain homely charm.

The last program under review from Superior Software is Fruit Machine. This gives you a fruit machine on your screen. You can nudge or hold, collect or gamble. It is just like the real thing — except, of course, that there is no money. The program generously gives you a credit of 20 to begin, and when it has cleaned you out you can start all over again. It is difficult to image who this program will appeal to; are there fruit machine addicts who play for the sheer fun of it? If so, then this is their program. The graphics are very good and with a little imagination you might be able to convince yourself you are in Las Vegas. Perhaps it will help to wean compulsive gamblers.

From Program Power come Alien Destroyer and Laser. Both have good, colourful graphics and a range of skill levels. The first is an Invader-style game with a variety of bombs and attackers. An engaging detail is the little yellow man who leads you back to the starting position when you have been destroyed. Another bonus for connoisseurs is the Battle Report you receive after each game; percentage of hits, number of torpedoes fired, and so on. Laser is a version of Missile Command, and quite a good one. All the familiar features are there and the player has a





SURVEY WARE

wide range of options — perhaps too many *unless you are as familiar with the keyboard as a touch-typist.*

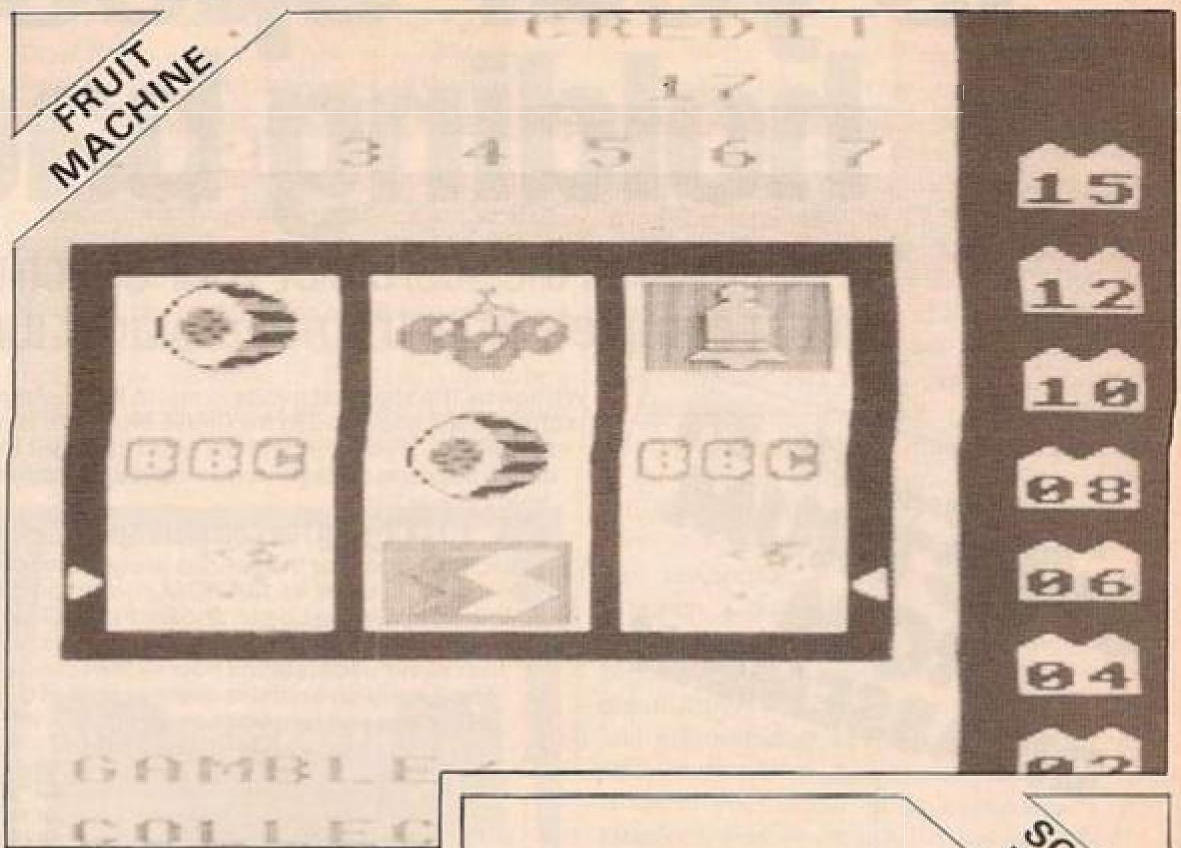
The new version of Chess by Program Power is a great improvement, mainly because it is now in colour. The board is very clear — in bright red and green — and the pieces are well-defined. It plays a vigorous attacking game at level 2 and makes its moves very quickly. It is prone to commit a computer's version of human error — that is, losing its queen — but obviously plays a more thoughtful game at the higher levels.

In contrast to games of death and destruction, BBC Software have produced a tape called Games of Strategy. If there's anything left of your brain after a few hours of Galaxians you might like to try Galaxy, Gomoku, Masterbrain or Reversi.

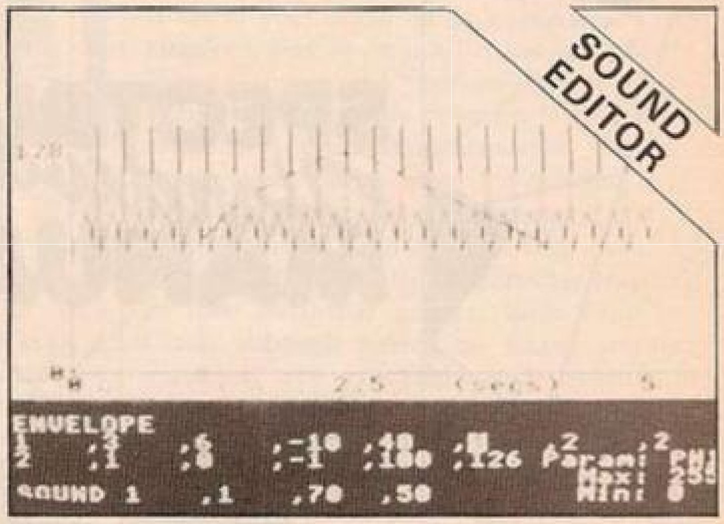
In Masterbrain you have to discover a four-figure digit the computer is "thinking" of, and it has to discover yours. Reversi and Gomoku are both well-known territorial possession board games. Galaxy is another territorial game, pitting you — on board the starship *Endeavour* — against the invading Kryons. By plotting co-ordinates on the screen you can destroy the invaders by firing phasers and photon torpedoes. None of these games is particularly interesting graphically, but that's not the point. If you like board games or logical games, you might enjoy them.

Acornsoft's version of Galaxians is called Arcadians and is written by someone calling himself Orlando. Perhaps he really is called Orlando. Pseudonymously or not, Orlando has written a very good program; definitely the best available Galaxians-style game for the BBC. A jolly little tune announces the beginning, after which you are rapidly destroyed. But you soon get the hang of it, and the game improves as you proceed through the pages.

Although not written by Orlando, Acornsoft's Super Invaders is also the best of its kind for the BBC. It has three levels of difficulty. The first two, A Mild Encounter and An


FRUIT MACHINE

Uncomfortable Situation, are in the traditional mould with the invaders and their missiles encroaching more quickly on your position. In the third level, rather exaggeratedly called A Terrifying Experience, the invaders' bombs float down and home in on you. They do not often miss. This is an exciting and well-executed version of a game which had almost lost its interest.


SOUND EDITOR

Better than both these games, though, is Rocket Raid, Acornsoft's answer to Scramble. You must pilot your ship over jagged landscape, bombing the fuel dumps and blasting the rockets. The controls are similar to the ones used in Defender but are more conveniently positioned on the keyboard. This first stage is deceptively simple.

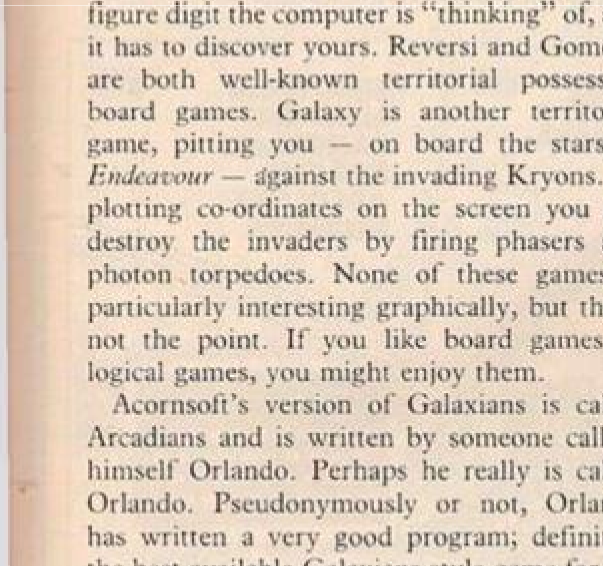
No sooner have you successfully negotiated these paltry obstacles than you are confronted by one of the most awesome sights in home computer games; the cavern. Grown men have screamed in anguish as, time after time, their ships has been destroyed by the viciously oscillating green yo-yos called phizzers. Eventually of course, you get through, only to be confronted by the meteorites — approaching at different altitudes, they cannot be destroyed but must be avoided. With your nerves shot to pieces by the ordeal of the Cavern you do not last long here. So you go back, to the beginning, to the Cavern and the phizzers and . . . When you have flown about a hundred missions you might get through to the skyscrapers, or the maze, or even the fabled deserted city. Then you can start all over again.

All three games have excellent graphics and sound quality and are probably worth the extra money as they are definitely the best on the market.

Level 9 have produced two adventure games; Adventure Quest and Dungeon Adventure. These two programs seem to be an attempt to exploit the vogue for fantasy and role-playing games such as Dungeons and Dragons. Add a touch of Tolkien and just a hint of *Conan The Barbarian* and you have the scenario; quaintly-yclept wizards and knights encounter evil and violence — but no sex — in steaming primeval forests and war-ravaged wastelands.

Beneath the odd vocabulary and exotic props they are, of course, ordinary adventure games. As such, they are as good as any other. You are an apprentice wizard who, in order to save Middle Earth has to seek out and destroy the evil Lord Agaliarept in his dark tower. When I was an apprentice wizard I was quickly eaten by ravenous wolves but the program kindly resurrected me and I received the blessing of Typo, God of Adventures. It

(continued on page 53)




ROCKET RAID

Is your Spectrum holding back?

Unlock all the secrets of your Spectrum with the most complete Spectrum Software Library available.



Written by the sharpest minds in micro technology today, this comprehensive library of software will allow you to maximise the entire range of your Spectrum's impressive capabilities. If you demand the best from your Spectrum, cut out and mail the coupon today, because once you've unlocked all the secrets of your Spectrum – there'll be no holding you back.

NEW RELEASE: The Complete Spectrum ROM Disassembly

This is the book for the serious programmer who wants to get right to the heart of the Spectrum system; its 16K ROM control program.

Written by Dr. Ian Logan and Dr. Frank O'Hara, each ROM routine is completely disassembled and its function clearly explained. Great care is also taken to ensure the reader understands how all the routines within the ROM interact with each other. The book also explains every aspect of the Spectrum's software operation in detail and makes all functions and entry points available for use in your own programs and routines. **£9.95**

NEW RELEASE: Spectrum Hardware Manual

An essential aid for every Spectrum user, giving an easy to follow explanation of how this sophisticated micro computer really works, written by Adrian Dickens.

Backed up with a complete rundown on each component's function and full circuit diagrams, the book reveals many features of the Spectrum system not mentioned in the Sinclair Manual.

The book also includes practical hardware projects and tips enabling you to take full advantage of the system's hardware potential. **£5.95**



Understanding Your Spectrum
A complete overview of Spectrum software systems explaining both BASIC and machine language programming. £7.95

Over the Spectrum
30 exciting programs and games to test you and your Spectrum plus many programming hints and tips too. £6.95

Spectrum Machine Language For The Absolute Beginner
Everything the first time user needs to know about Spectrum Machine language. £6.95

MELBOURNE HOUSE PUBLISHERS

Orders to: 131 Trafalgar Road, Greenwich, London SE10

Correspondence to: Glebe Cottage, Station Road, Cheddington, Leighton Buzzard, BEDS LU7 7NA

Trade enquiries welcome.

☐ Please send me your free catalogue.

Please send me:

Books

SPECTRUM

☐ Understanding Your Spectrum	£7.95
☐ Spectrum Machine Language For The Absolute Beginner	£6.95
☐ Over The Spectrum	£6.95
☐ The Complete Spectrum ROM Disassembly	£9.95
☐ Spectrum Hardware Manual	£5.95

DRAGON

☐ Enter The Dragon	£5.95

ZX81

☐ Machine Language Made Simple for the ZX80 & ZX81	£8.95
☐ Not Only 30 Programs	£4.95
☐ Understanding Your ZX81 ROM	£8.95
☐ Complete Sinclair Basic Course	£17.50
☐ Basic Course cassettes	£2.50
☐ Complete Sinclair ZX81 Rom Disassembly Part A & B	£9.95
☐ Ins and Outs of the Timex TS1000	£5.95

VIC 20

☐ VIC Innovative Computing	£6.95

Cassettes

16K SPECTRUM

☐ Over The Spectrum No. 1	£5.95
☐ Over The Spectrum No. 2	£5.95
☐ Over The Spectrum No. 3	£5.95
☐ Programs from Spectrum Machine Language Book	£5.95

48K SPECTRUM

☐ Penetrator	£6.95
☐ The Hobbit	£14.95

STANDARD VIC 20

☐ VIC Innovative Cassette 1	£5.95
☐ VIC Innovative Cassette 2	£5.95
☐ VIC Innovative Cassette 3	£5.95
☐ VIC Games Pack	£5.95
☐ The Wizard & The Princess	£5.95

All prices include VAT where applicable

£ ________

Please add 80p for post and pack £ .80

TOTAL £ ________

All Melbourne House cassette software is unconditionally guaranteed against malfunction.

Access orders can be telephoned through on our 24-hour ansafone (01) 858 7397.

I enclose my cheque/money order for £ ________

Please debit my Access card No. ________ Expiry date ________

Signature ________ Name ________

Address ________

Postcode ________

YC3

MELBOURNE HOUSE PUBLISHERS

(continued from page 51)
did not do me much good, and for all I know the Middle Earth is still waiting to be saved by a brave and ingenious adventure game fan.

Dungeon Adventure is related to the previous game; now you must find the dead demon lord's treasure in his black tower. Both these programs have a Save facility and come with an explanatory booklet. Enclosed is a stamped addressed envelope which entitles you to one clue from Level 9.

It was encouraging to see that software houses are now producing more programs of a practical or educational intent. Program Power offer Constellation, which enables the user to view the stars from any point on the Earth's surface, on any date and at any time. You enter latitude and longitude, date and time and telescope elevation; and, behold, on the screen is displayed a map of the heavens!

You can zoom in or out, thus allowing you to have a close-up of one particular constellation or a broad view of the whole area. This program will probably appeal mainly to budding astronomers as an easy method of finding their way about the stars before going on to the real thing.

If you are more interested in money than the mysteries of the cosmos, then Compute-a-draw from Davansoft will be more to your taste. Its manufacturers claim that by using it carefully you can predict draws with about 20-30 percent more success than picking them with a pin. They do not promise you a fortune; only the opportunity of winning several smaller dividends each season.

This program comes in two parts; the prediction program, £4.95, and the database, £13.50. The latter is, obviously, essential and the work that has gone into it justifies the price. It contains the results from about 6,650 matches over the last three seasons, up to January 15 of this year. If you do buy this program, then you will have to be prepared for a fair amount of work; adding information to the database, running the program before making selections, reading the copious explanatory notes.

Perhaps the most difficult commands to master in the BBC Micro's repertoire are the Sound and Envelope commands with their 18 parameters. Davansoft's Sound Editor is designed to make them easier to use. It draws the graphs of the pitch and amplitude envelopes over the same axes; the parameters are printed below and can be easily entered by moving the cursor. When you alter one of them the program enables you to discover the effect by redrawing the envelope shape and producing the new sound.

BBC Software has produced two programs exploiting the graphic capabilities of the BBC computer; Painting and Drawing, both by Brian Smith of the Royal College of Art. Although the controls for these two programs are rather complex, they both come with clear explanatory booklets. In Painting you have a good variety of colours to choose from. There is also a choice between brush and airbrush — which "paints" in a cluster of dots. Other



options are to vary the width of brush, use hatching or vary background colours. Drawing allows you to create circles, polygons and other shapes with different sizes and effects. In both of these programs brush or line movement is controlled by the cursor keys; it is thus rather difficult to draw, for instance, a curve. If you want to explore the BBC's graphics these programs could be useful. If you want to learn how to draw then you should buy pencil and paper.

Anyone who is interested in making the most of the BBC Micro's graphics might be better advised to take a look at Acornsoft's Creative Graphics. Best described as a compendium of graphics techniques and ideas, the tape contains 36 Basic programs which produce a variety of pictures and patterns. These include rotating 3D shapes, animated pictures and elaborate and constantly-changing designs.

One of the most impressive things about this collection is how short the programs are. Few of them would take long to key in; yet they achieve the sort of effects that are only available with machine code, if at all, on most other home micros. This reflects both on the scope of the BBC Basic and the ingenuity of the author, John Cownie.

To extract maximum benefit from these programs the aspiring computer artist should buy the Creative Graphics book, which is available separately for £7.50.

Acornsoft's Tree of Knowledge is an educational game in two parts. The first, Fruit, is intended for children of primary school age. Either they ask the computer, or the computer asks them, questions whose aim is to discover the fruit thought of. The computer might ask "is it a citrus fruit?" and if the children do not know what this is they will find out, thus placing citrus fruits on the Tree of Knowledge. This idea of classification and connection is continued in the second program, Class, which is meant to increase a knowledge and understanding of the classification of living creatures. You think of an organism and the computer asks "is it green and multicellular?" From your answer to this and succeeding questions the computer consigns your organism to a kingdom, a sub-kingdom, and so on until it has identified it. When it has found your creature it gives a smug "Ho-ho". This program is specifically aimed at A-level biology students — a point driven home to me when I was asked if my organism was diploblastic, coelomate and had a notocord. For them it will be very useful as a means of learning why creatures are classified in their particular groups. Both Fruit and Class, although having no sound and few graphics, are enjoyable and worthwhile educational games.

Wordwise, a word processor on a ROM chip from Computer Concepts, is considerably more sophisticated than most of the word processors available on tape.

The advantage of having software in ROM is that it can occupy the memory space that would otherwise be filled by the Basic interpreter and so does not take up any user RAM. This means that there is room for 24,560 characters to be stored — about 4,500 words. Wordwise, incidentally, keeps a count of the number of words typed in, which it displays in a status line at the top of the screen.

Another bonus is that a program in ROM is instantly accessible. To switch from Basic to Wordwise you simply type in *Wordwise, and *Basic to switch back.

On some word processors the screen can be horizontally scrolled over a much wider page of text. With Wordwise text must be entered and edited in Teletext mode. It can then be viewed in a formatted state at 80 characters to the line.

There is an extensive range of editing facilities most of which are easy to use. Sections of text can be readily deleted, shifted and copied; previously-Saved text can also be inserted from tape or disc. A search option allows you to replace every occurrence of specified string of characters by an alternative string.

These are just some of the features Wordwise offers. At the moment it is probably the most useful word processor on the market and is the only one on a chip. It will be interesting to see how Acornsoft's View — which will also be in ROM — compares. ■

Company	Software	Price
BBC Software, BBC Publications, PO Box 234, London SE1 3TH.	Games of Strategy Painting Drawing	£10 £10 £10
Level 9 Computing, 229 Hughenden Road, High Wycombe, Buckinghamshire	Adventure Quest Dungeon Adventure	£9.90 £9.90
Program Power, Dept YC2, 8/8a Regent Street, Chapel Allerton, Leeds LS7 4PE.	Chess Alien Destroyer Laser Constellation	£6.95 £6.95 £6.95 £5.95
Davansoft, 1 Delapoer Drive, Haverfordwest, Dyfed SA61 1HX.	Compute-a-draw Sound Editor	£4.95 £5.95

Company	Software	Price
Acornsoft, 4a Market Hill, Cambridge CB2 3NJ.	Rocket Raid Arcadians Super Invaders Tree of Knowledge Creative Graphics	£9.95 £9.95 £9.95 £9.95 £9.95
Superior Software, 69 Leeds Road, Bramhope, Leeds.	Centipede Galaxians Invaders Alien Dropout Space Fighter Fruit Machine	£6.50 £6.50 £6.50 £6.50 £6.50 £6.50
Computer Concepts, Dept YC4 16 Wayside, Chipperfield, Hertfordshire WD4 9JJ.	Wordwise	£45

MOZART LIVES



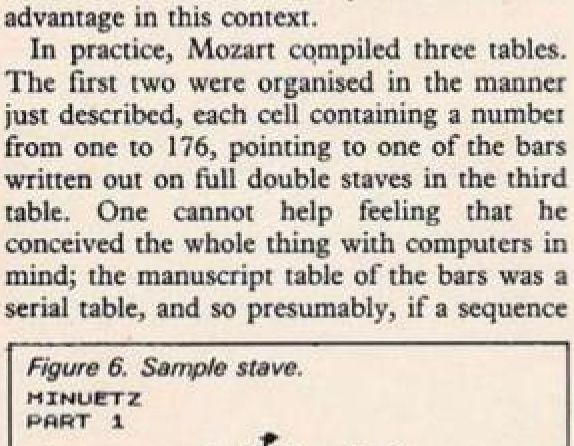
YOU CAN COMPOSE instant Mozart with a little known opus called the *Dice Waltz*. In effect, this was an automatic generator of minuets. This claim holds true in spite of the fact that Wolfgang Amadeus never heard most of the theoretically possible 4.6E16 variations! It was constructed in this manner: Mozart assembled 176 musical bars of two types, suitable for the two parts into which each "minuet" would be divided. The two groups of 88 bars were arranged into tables of eight columns and 11 rows, each element of a column representing a single, three-eight bar.

In each column the bars were written or selected such that any bar in one column could be played after any bar taken from the column to its left, and before any bar taken from the column to its right. In the first table, a sequence of bars selected in order from the first to the eighth columns would combine to form a minuet beginning in the key of the tonic, and modulating by the last bar to the dominant — for example C to G. Providing the normal symmetry, though not that of the traditional AABA minuet, the second table contributes bars opening on the dominant and working their way back to the tonic. Each half would of course be repeated, giving a total of 32 bars per minuet.

As the title of Mozart's work suggests, the bars to be played were chosen by throwing a pair of dice. The range of numbers possible from a pair of dice is two to 12, and so the rows of the two tables were labelled accordingly, 16 throws in all generating the required bars in a hopefully random fashion. Loaded dice would definitely have been a disadvantage in this context.

In practice, Mozart compiled three tables. The first two were organised in the manner just described, each cell containing a number from one to 176, pointing to one of the bars written out on full double staves in the third table. One cannot help feeling that he conceived the whole thing with computers in mind; the manuscript table of the bars was a serial table, and so presumably, if a sequence was to be played through on the piano or clavichord with any comfort, the bars would have to be transcribed in full on to a separate sheet of manuscript.

Figure 6. Sample stave.



Our program attempts to preserve the flavour of the original. The user actually throws the dice, which tumble across the screen to reveal the desired numbers on their top faces. And to complete the charade, appropriate numbers appear on the other two visible faces. A count of the number of throws made is displayed, and on completing 16 throws, a tabular record of the dice numbers is provided. Next, the manuscript of the music generated by the dice sequence may be printed on the screen in two sections, representing parts one and two of the minuet. After each part is printed, like the original, in three voices and on two staves, the option is given to Save the manuscript. This will be as hard copy if a printer is connected, or on tape as a named Screen if not. Then, after prompts for volume and tempo, and in one of two keys, the music will be played through in three-part harmony, and of course, may be repeated if desired. Other refinements are included, such as the ability to fix the dice, and so generate a predetermined sequence of bars.

By now the astute reader will have realised the *raison d'être* of the hardware. Valiant though it is, the Spectrum beeper cannot cope with more than one voice at a time. A General Instruments chip, the AY-3-8910 provides not only the three sound channels needed for our purpose, but also two entirely independent and bi-directional I/O ports, each of eight bits. Moreover, the chip is simplicity itself to program for most purposes, either in machine code or Basic, and equally convenient to drive in hardware terms. The spare appearance of the PSGIO board — Programmable Sound Generator and Input/Output — will bear the latter out.

Having said that the Spectrum beeper is not man enough to handle full-blooded, three-part Mozart, some readers will no doubt be relieved to hear that the software can be largely proved using the beeper before any hardware is actually connected. In fact, the program will automatically detect the lack of the interface and default to beeper. It must be stressed however, that the beeper routine gives only a very crude foretaste of the real thing.

The circuit of the PSGIO board is very straightforward, using only the AY-3-8910, two cheap 14-pin LS TTL integrated circuits, a common eight-pin audio amplifier chip and a small handful of discrete components.

It lays out naturally on 0.1in. pitch Vero board, with very little in the way of track-cutting or wiring involved. A ZX-81 type connector should be used, since this allows the simultaneous use of a ZX Printer. This connector has 23 pins per side, as opposed to the 28 boasted by the Spectrum; the shell of the printer extender will only admit a 23-way

Roll those dice and set Mozart spinning in his grave. Rod Hopkins applies the power of a Spectrum to the *Dice Waltz* to compose millions of genuine Mozart minuets that the maestro never heard.



connector. Taking this course also has the advantage that the board might be used with a ZX-81.

It is recommended that the connector be mounted on the board itself, and the whole plugged directly on to the Spectrum or printer connector without intervening wiring. The Spectrum is frustratingly sensitive to the loading caused by even the shortest of cables.

All of the components used in the circuit are readily available from the majority of suppliers advertising in the electronics monthlies.

Communication with the PSG is register-orientated. In practice, this means that the programmer first tells the chip which register he wishes to alter or read, and then sends or retrieves the relevant data to or from the register specified. All functions are controlled internally by the PSG, and may persist thus while the controlling program is busy with other matters. To perform these functions, the PSG makes use of the data programmed into its register array, numbered 0-15. Table 1 summarises the signal requirements of the two control pins of the 8910 that are used.

Table 1.

BDIR	BC1	
0	0	Inactive
0	1	Read from PSG
1	0	Write to PSG
1	1	Latch PSG Register Address

They are met by decoding two I/O addresses — that is, eight-bit addresses combined with the CPU signal IORQ — to talk to the chip, namely 221 and 223. The former address plays a dual role: OUT 221,X will prepare the PSG for a data transfer involving register X. On the other hand, IN 221 will have as its result the contents of the register last pointed to by an OUT 221 instruction: for example, PRINT IN 221 will print those contents. The other I/O address used, 223, is the output data destination address, if you like. OUT 223,Y writes the value Y into the register last referred to by an OUT 221 instruction.

All of the PSG registers are eight-bit registers, although some of them are handled as pairs. Note that Bit 0 is the least significant bit — LSB — while Bit 7 is the most significant — MSB. If two registers are combined, the register with the higher address — number — constitutes the most significant byte, the summed value of their contents being the low-register value plus 256 times the high-register value.

The value of each register bit, of course, can only be either a logic 1 or a logic 0; but, in their proper positions, the bits collectively form a binary number whose decimal equivalent can be calculated by adding together the weighted values of any bits set to 1, thus:

BIT 7	BIT 6	BIT 5	BIT 4	BIT 3	BIT 2	BIT 1	BIT 0	
1	1	1	1	1	1	1	1	
128	64	32	16	8	4	2	1	= 255
1	0	1	1	0	0	1	1	
128	0	32	16	0	0	2	1	= 179

If, for instance, a register contained zero, all bits would be reset, that is logic zero. And, to set a particular bit to logic 1, simply write into the register the decimal value of that bit, plus those of any other bits required set. Conversely, if a register were to contain 255, that is, all bits set to 1, and the need were to reset to zero bits 0,1 and 2, it would be necessary to write into the register:

$$(255-4-2-1)=248$$

Now to move on to the PSG registers. Remember first of all that the chip has three sound channels, referred to as A,B and C; and note further that the two highest registers, 14 and 15, are used to transmit and receive data via the two I/O ports available. The PSG registers are utilised as follows:

Register	
0, 1	Set Channel A Tone Period
2, 3	Set Channel B Tone Period
4, 5	Set Channel C Tone Period
6	Set random noise period on all channels.
7	Enable noise and/or tone on all channels. Control direction of I/O transfers for both ports.
8	Set Channel A amplitude
9	Set Channel B amplitude
10	Set Channel C amplitude
11	
12, 13	Set Envelope period and shape according to same pattern.
14	I/O Port A data
15	I/O Port B data

Channel tones are set by writing values into registers 0-5, each voice using two registers.

(continued on page 57)

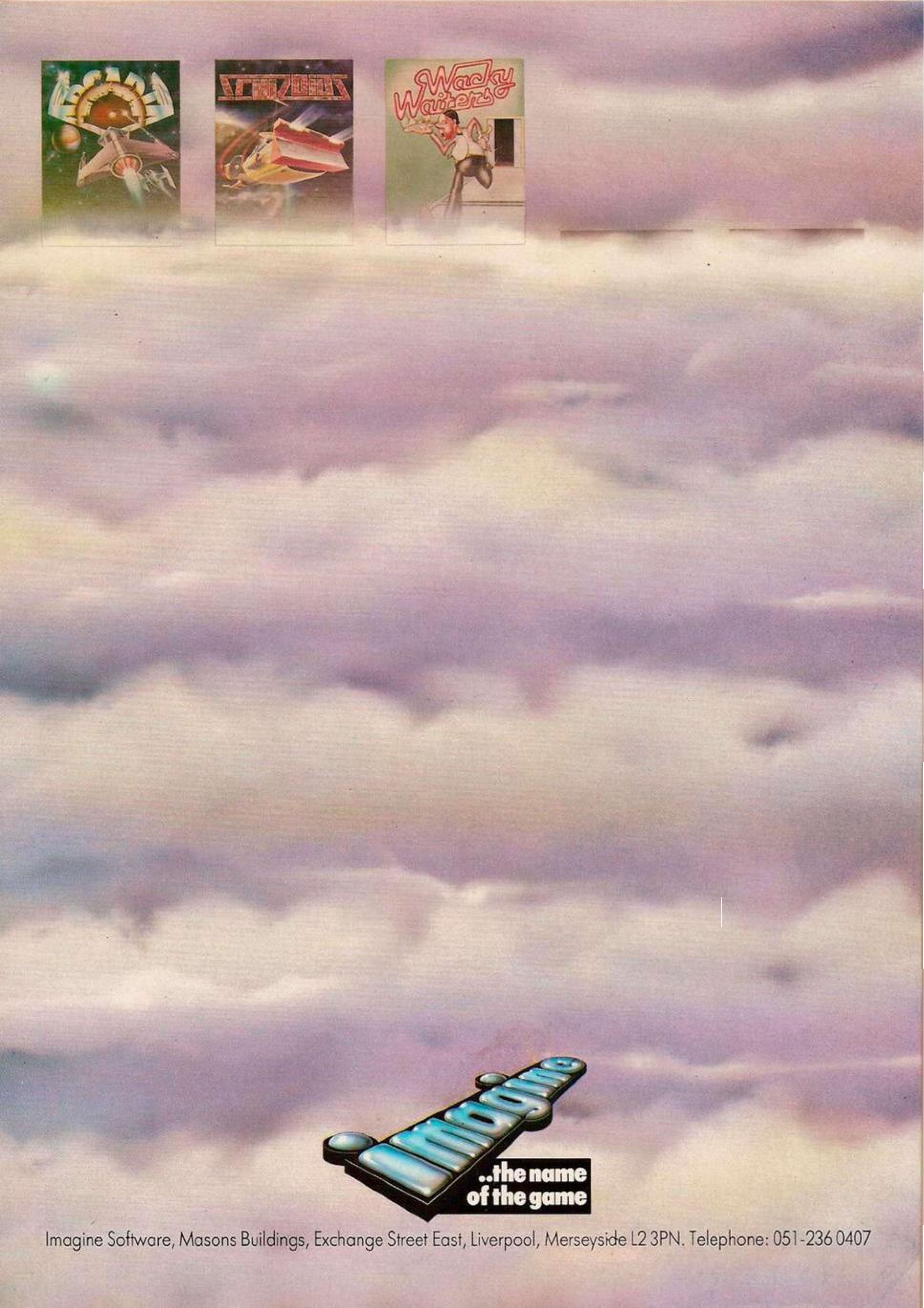
Figure 1. The Basic program.

```
"MINUETZ"

R.K. HOPKINS & M.J.LAVERTY 1983

   1 CLEAR VAL "28929": LOAD ""C
ODE : GO TO VAL "3"
   2 SAVE "A          "SCREEN$
RETURN
   3 LET B=VAL "1": LET A=B-B: L
ET C=B+B: LET D=C+B: LET E=D+B:
 LET F=E+C: LET VO=C: LET KY=(E+
B)/F: LET R=VAL "221": LET RO=R+
C: LET LD=VAL "32159": LET RD=LD
+B: LET DT=VAL "31518": LET DI=V
AL "31998": LET VT=VAL "32161":
LET BV=VAL "32291": LET RN=VAL "
32281": LET SORT=VAL "32276": LE
T RNDT=VAL "32209"
   4 OUT R,A: OUT RO,F: LET PL=V
AL "32350"+137*(IN R<>F): IF PEE
K 31416<>146 THEN LET KY=B/KY
  36 LET O=VAL "256": LET L=RND*
O: RANDOMIZE L*O: LET KY=B/KY: B
ORDER A: PAPER A: INK E+D: CLS :
 LET AU=A: LET CO=A: POKE VAL "2
3658",F+F: PLOT E*F,40: DRAW A,1
20: DRAW 220,A: DRAW A,-120: DRA
W -220,A: OVER B: PRINT AT D,E;"
DO YOU WISH TO :";AT F,E;" 1. GA
MBLE WITH THE DICE ?          or
,";AT F+E,E;" 2. PREDICT THE FAL
L OF              THE DICE ?   or
";AT F+E+E,e;" 3. COMPOSE AUTOMA
TICALLY?": INPUT " ENTER 1,2 OR
3 ";A$: IF A$="3" THEN LET AU=B:
 GO SUB 9930: GO TO 207
  38 OVER A: IF A$="2" THEN LET
CO=B
  40 INVERSE A: DIM M(16): FOR Q
=A TO 15: PRINT AT 21,A;"THROW [
 ENTER ]": PAUSE VAL "4E4"
  41 LET M=INT (RND*F)+B: RANDOM
IZE RND*5E4: LET L=INT (RND*F)+B
  42 IF Co THEN INPUT "No. ON LE
FT DICE ?";M: IF M<B OR M>F THEN
 GO TO 42
  43 IF CO THEN INPUT "No. ON RI
GHT DICE ?";L: IF L<B OR L>F THE
N GO TO 43
  44 POKE LD,M: POKE RD,L: POKE
RNDT+Q,L+M-C: LET M(Q+B)=L+M
  50 DATA 235,160,180,165,170,12
5,217,110
  60 CLS : RESTORE 50: FOR s=10
TO -17 STEP -27: FOR n=B TO C: R
EAD x,y: GO SUB 9000: NEXT n: CL
S : NEXT s
 200 PRINT AT A,A;: RANDOMIZE US
R DI: PLOT E,171: DRAW 22,A: DRA
W A,-14: DRAW -22,A: DRAW A,14:
PRINT AT B,B; INVERSE B;Q+B: INV
ERSE A: NEXT Q: INPUT "'ENTER' T
O CONTINUE ";A$
 205 FOR n=B TO 22: RANDOMIZE US
R 3582: POKE 23692,-B: PRINT "
00000": NEXT n
 207 GO SUB VAL "9890": DIM M(1)
: IF AU THEN GO TO O-F
 210 LET P1=b: INPUT "Manuscript
 ?(Y/N) ";a$: IF A$<>"Y" THEN GO
TO O-F
 220 POKE RN,209: GO SUB VAL "99
16": PRINT AT A,A;"PART ";P1: PO
KE RN,209+(P1-B)*8: GO SUB 8500:
 INPUT " SAVE manuscript ?(Y/N)"
;A$: IF A$<>"Y" THEN GO TO 230
 222 INPUT "TITLE ? ";A$: IF LEN
 A$>F+E THEN LET A$=A$( TO F+E)
 224 IF IN 251=O-B THEN FOR N=B
```

(listing continued on page 57)


Wacky Waiters
Imagine
..the name of the game
Imagine Software, Masons Buildings, Exchange Street East, Liverpool, Merseyside L2 3PN. Telephone: 051-236 0407

(continued from page 55)

Of each pair, the higher register only uses the four lowest bits. This means that the highest combined value that can be programmed for any channel is:

$$255 + 256 * (8+4+2+1) = 4095$$

An external oscillator or clock frequency is applied to pin 22 of the PSG chip. As a preliminary, this frequency is divided by 16 before being directed to the three channels, where it is further divided down by the numbers stored in the relevant tone period register pairs, producing the output frequency for each channel:

$$\frac{\text{CLOCK frequency}}{16 * \text{Tone Period Value}}$$

Amplitude Control is set by ignoring envelope control and writing into registers 8,9 and 10 any value from 0 to 15, the resulting volume being proportional to the number programmed.

To enable the channels and the I/O individual bits of register 7 are used for this purpose as follows:

1 = O/P   0 = Channel ON
0 = I/P   1 = Channel OFF

BIT 7	BIT 6	BIT 5	BIT 4	BIT 3	BIT 2	BIT 1	BIT 0
I/O	I/O	C	B	A	C	B	A
B	A	NOISE			TONES		

Writing (255 − 4 − 2 − 1) = 248 into register 7 would thus switch on the tone outputs of all three channels, switch off noise on all three, and set both I/O ports to output mode. These bit switches are active when zero.

When you have built or acquired a PSGIO board, try the following routine, which simply demonstrates how to output a tone from channel A, and then switch it off. It is as easy as that; and the most complicated sound programs are little more than collections of similar instructions:

Program line	Rem
10 OUT 221,0	Point to channel A register 0.
20 OUT 223,200	Set tone period to 200. Leave register 1 at zero
30 OUT 221,8	Point to register 8.
40 OUT 223,10	Set channel A volume to 10.
50 OUT 221,7	Point to register 7.
60 OUT 223,254	Switch on channel A only bit 0 now equals 0.
70 INPUT "Press ENTER to switch off",A$	
80 OUT 223,255	PSG still pointing to register 7. Writing 255 to it sets bit 0 to 1.

Do not bother typing in the remarks; they are only included to make you feel quite certain as to what the routine is doing. Try adding extra lines in between lines 10 to 50 to program tones or noise for channels B and C. Remember to set the volume for each voice used, and to change line 60 to switch the required voices on.

First the Basic program — see figure 1. The only points to watch are that the length of line 1 remains unaltered; music manuscript file names are Poked into the Save expression in the following line, so that any additions to line 1 could cause havoc. Also, be careful with the machine-code addresses set up at the beginning of the program. Save the Basic at

(continued on page 59)

(listing continued from page 55)

```
TO LEN A$: POKE VAL "23765"+N,CO
DE A$(N): NEXT N: GO SUB C: FOR
N=B TO F+E: POKE VAL "23735"+N,C
ODE " ": NEXT N: GO TO 230
 226 LPRINT A$: LPRINT : COPY :
LPRINT
 230 LET P1=P1+B: IF P1=C THEN G
O TO 220
 252 INPUT "ENTER VOLUME(1-6) ";
VO: IF VO>F THEN GO TO 0-E
 253 INPUT "TEMPO (1-6) ";L: IF
L<B OR L>F THEN GO TO 0-D
 254 POKE VAL "32385",115+L*F: I
NPUT "'ENTER' TO CONTINUE ";A$:
FOR N=VAL "31416" TO VAL "31517"
 STEP C: LET L=(PEEK N+O*PEEK (N
+B))*KY: POKE N,L-(INT (L/O)*O):
 POKE N+B,INT (L/O): NEXT N: GO
SUB VAL "9820": CLS : GO TO F
8530 LET Z=A: POKE BV,240: DIM N
(7): FOR V=B TO D: RANDOMIZE USR
 SORT: LET TS=VT: LET YS=CODE "P
": FOR G=B TO C: FOR L=A TO D
8540 DIM A(7): FOR T=C TO F+B: L
ET N(T)=PEEK TS: LET TS=TS+B: IF
 N(T)>127 THEN LET A(T)=B: LET N
(T)=N(T)-128
8546 NEXT T: GO SUB 8660
8550 LET P=18+L*60: FOR T=C TO F
+B
8560 LET U=B: IF NOT S(T) THEN G
O TO 8630
8570 LET X=P+(T-C)*10: LET Y1=(N
(T)-B)*D: IF (v=D AND y1>14) OR
(V=B AND Y1>68) OR (V=C AND Y1>5
0) THEN LET U=-B
8575 IF NOT Y1 OR Y1=F OR Y1>72
AND U=B AND INT (Y1/F)=Y1/F THEN
 LET Z=B
8585 LET Y=YS+Y1: IF S(T)<>5 THE
N GO TO 8610
8590 IF V=C THEN GO TO 8630
8600 LET Y=YS+32: IF V=B THEN LE
T Y=Y+32
8605 CIRCLE X,Y,B: GO SUB 8775:
GO TO 8630
8620 CIRCLE X,Y,B: CIRCLE X,Y,C:
 PLOT X+C*U,Y: DRAW A,11*U: GO S
UB 8770+S(T)
8625 IF Z THEN PLOT X-E,Y: DRAW
8,A: IF V=Z THEN PLOT X-E,Y-F: D
RAW 8,A
8626 IF z AND v=D THEN PLOT x-E,
y+F: DRAW F,A
8627 IF A(T) THEN PLOT X-8,Y: DR
AW F,A: PLOT X-8,Y+C: DRAW F,A:
PLOT X-7,Y-C: DRAW A,F: PLOT X-E
,Y-C: DRAW A,F
8630 LET Z=A: NEXT T: NEXT L: LE
T YS=C: NEXT G: POKE BV,240+V: N
EXT V: RETURN
8660 DIM S(7): IF NOT N(C) THEN
GO TO 8670
8665 LET Q=A: FOR N=C TO F: IF N
(N)<>N(N+B) THEN LET Q=B
8666 NEXT N: IF NOT Q THEN LET S
(C)=C: LET S(E)=C: LET S(F)=C: R
ETURN
8670 FOR N=C TO 7: IF NOT n(n) T
HEN LET s(n)=5: LET n=n+B: GO TO
 8710
8690 IF n(n)=n(n-B) THEN GO SUB
8730: GO TO 8710
8700 LET s(n)=B
8710 NEXT n: RETURN
8730 FOR Q=B TO D: IF N(N-Q-B)<>
N(N-Q) THEN LET S(N-Q)=S(N-Q)+B:
 RETURN
8732 NEXT Q: LET S(N-E)=S(N-E)+B
: RETURN
8771 DRAW D,-E*U: DRAW -D,E*U: D
RAW A,-E: DRAW D,-E*U: RETURN
8772 DRAW D,-E*U: RETURN
8773 DRAW D,-E*U: CIRCLE X+E,Y,B
: RETURN
8774 RETURN
8775 DRAW 5,C,PI: DRAW -D,-8: RE
TURN
9005 PLOT X,Y: DRAW s,s*D/E: DRA
W s,-s/C: DRAW -s,-s: DRAW -s,s*
D/E: DRAW A,-s: DRAW s,-s*D/E: D
RAW OVER B;A,s: DRAW A,-s: DRAW
s,s: DRAW A,s: RETURN
9800 POKE VAL "32291",240: INPUT
 "Repeat ?",a$: IF A$<>"Y" THEN
RETURN
9830 POKE VAL "32291",240: FOR N
=A TO E+B: OUT R,N: OUT RO,A: NE
XT N: OUT R,E+E: OUT RO,E+VO: OU
T R,F+D: OUT RO,E+VO: OUT R,F+E:
 OUT RO,E+VO: OUT R,F+B: OUT RO,
248
9835 RANDOMIZE USR PL: OUT R,F+B
: OUT RO,-B: GO TO VAL "9800"
9890 LET p=DT-11: FOR n=A TO 15:
 LET p=p+11: POKE RNDT+N,PEEK (P
+PEEK (RNDT+N)): NEXT N: IF AU T
HEN RETURN
9900 CLS : PRINT AT C,F+E;"Dice
Record": PLOT A,145: DRAW O-B,A:
 DRAW A,-70: DRAW -O+B,A: DRAW A
,70: PLOT 60,75: DRAW A,70: OVER
 B: FOR K=A TO B: PRINT AT F+K*E
,B;"PART ";K+B;: FOR N=B TO 8: P
RINT TAB 5+N*D;M(K*8+N);: NEXT n
: NEXT K: OVER A: RETURN
9916 BORDER D+E: PAPER D+E: INK
F+D: CLS : LET Q=9923: LET L=14:
 GO SUB Q: LET L=N+F: GO SUB Q:
LET L=N+C*F: GO SUB Q: LET L=N+F
: GO SUB Q: LET L=44: GO SUB Q+B
: LET L=122: GO SUB Q+B: LET M=F
*F: PLOT C,M: GO SUB Q+C: LET M
=114: PLOT C,M: GO SUB Q+C
9917 FOR N=O-B TO 45 STEP -61: P
LOT N,14: DRAW A,60: PLOT N,92:
DRAW A,60: NEXT N: PLOT O-E,14:
DRAW A,60: LET L=O-F: CIRCLE L,2
3,B: CIRCLE L,29,B: CIRCLE L,59,
B: CIRCLE L,65,B: RETURN
9923 FOR N=L TO L+E*F STEP F: PL
OT A,N: DRAW O-B,A: NEXT N: RETU
RN
9924 PLOT E,L: DRAW E,A,C: DRAW
-C,32,-.1: DRAW E,A,-C: DRAW -9,
-F*C,-.6: DRAW F+F,A,3.3: DRAW -
4-C,-E,D: CIRCLE E,L,B: RETURN
9925 DRAW F,A,-C: DRAW -F,-C+F,-
1.2: CIRCLE C,M-B,B: CIRCLE 11,M
,B: CIRCLE 11,M-F,B: RETURN
9930 LET L=RND*O: RANDOMIZE L*O:
 FOR N=A TO 15: POKE RNDT+N,RND*
10: NEXT N: RETURN
```

Figure 2.

```
BARTABLE :LOCATED AT 28930-31413

[illegible]  K!3  CS-  M2.  M!)  MH)  A2.
             K!3  CS-  M2.  M!-  MH)  A2.
             H!0  @5-  F2.  H!5  H95  F2.
             H!0  A5-  F2.  J!5  H!3  F2.
             M!5  E!!  J!!  H!-  !52  J!!
             H!5  H!!  J!!  J!-  !!0  J!!

[illegible]  J5.  F!.  JF5  E!5  J!.  F>.
             F5.  F!.  JF5  C!5  F!.  F!!
             J5.  F!)  HE5  E!5  E!0  F>.
             M5.  F!)  HE5  F!5  C!0  F!!
             R!!  !!"  !!)  H!!  A!$  F>.
             M!!  !!"  !!)  E!!  @!$  F!!

[illegible]  F5.  J5.  040  F52  A2.  J5.
             F5.  J5.  040  A52  A2.  F5.
             A5.  M5.  L40  F52  F2.  J5.
             A5.  J5.  L40  J52  F2.  J5.
             >!!  F2.  H4.  A!!  J5.  M2.
             >!!  F2.  H4.  F!!  J5.  M2.

[illegible]  M!-  F!.  J!.  K!3  <!0  JF.
             M!-  J!.  J!.  J!2  @!0  JF2
             Q!-  M!0  F!.  H!0  C!0  FJ5
             T!-  H!0  F!.  J!2  H!0  FJ2
             H!!  C!$  A!!  K!3  L!.  JF.
             H!!  L!$  A!!  M!5  O!.  JF.

[illegible]  K95  L7.  E!5  J5.  M!)  J!5
             J95  M7.  H!5  F5.  M!)  F!5
             K95  C7.  M!5  A5.  M95  H!5
             H95  07.  H!5  A5.  M53  E!5
             F!!  L!!  E!)  J.5  !42  A!!
             E!!  H!!  E!)  J.5  !20  A!!

[illegible]  C40  C!.  M0-  F2.  !M-  F2.
             C40  J!.  00-  F5.  !M0  E2.
             H40  H!0  M0-  A2.  A!5  F2.
             H40  M!0  H0-  A5.  A!0  J2.
             L7.  L!$  E!!  J2.  !A-  A!!
             L7.  O!$  E!!  J5.  !A)  F!!

[illegible]  F2.  E!)  M2.  C!3  F52  M0-
             E2.  F!)  M2.  C!3  E52  M0-
             F2.  H!)  K2.  K!3  F52  00-
             J2.  E!)  J2.  H!3  A52  M0-
             A!!  C!!  H!!  C!5  >!!  H!!
             A!!  A!!  F!!  E!5  :!!  E!!

[illegible]  M0-  J5.  J2.  F52  F2.  H!3
             M0-  J5.  J5.  F52  A2.  G!3
             M0-  F5.  F2.  J52  J2.  H!3
             H0-  J5.  F5.  F52  F2.  K!3
             Q!!  M.2  A2.  A!!  M!!  A!5
             Q!!  R.2  A5.  A!!  J!!  E!5

[illegible]  JF.  M0-  M5)  M2.  M2.  F52
             JF.  M0-  E5)  M5.  M5.  F52
             FJ.  00-  A5)  J2.  F2.  J52
             KH.  00-  A5)  J5.  F5.  F52
             MJ!  H!!  !!5  F2.  J2.  H!!
             MJ!  H!!  !!5  F5.  J5.  M!!

[illegible]  J!.  J!.  J5.  H30  L70  F2.
             F!.  F!.  M5.  C30  L70  E2.
             E!0  E!.  R5.  H30  004  F2.
             A!0  F!.  M5.  H30  004  J2.
             C!$  A!!  J.5  L!!  L.0  A52
             @!$  A!!  F.5  L!!  L.0  F52

[illegible]  M!-  M2.  L!0  M0-  K!3  R2.
             M!-  M2.  L!0  00-  J!3  Q2.
             Q!-  J2.  O!0  T0-  H!3  R2.
             M!-  J2.  L!0  00-  F!3  M2.
             H!!  F!!  H!.  M-0  E!5  J!!
             M!!  F!!  L!.  M-0  H!5  F!!

[illegible]  LH.  R2.  M0-  F!.  H!.  H5-
             LH.  Q2.  00-  F!.  H!.  E5-
             HL!  R2.  M0-  :!.  C!.  A5-
             HL!  M2.  M0-  :!.  C!.  A5-
             LH.  J.5  H-5  !!"  L!!  M-0
             LH.  F.5  H-5  !!"  L!!  H-0

[illegible]  F52  H5-  M2.  M0-  K!3  L7.
             F52  H5-  M2.  H0-  J!2  07.
             J52  H5-  F2.  M0-  H!0  T7.
             J52  M5-  F2.  00-  H!0  07.
             A!!  Q!!  J.5  M-0  M!5  L.7
             A!!  Q!!  J.5  H-0  M!5  O.7

[illegible]  HE)  M0-  L7.  J5.  L7.  F52
             HE)  L0-  L7.  H5.  M7.  J52
             M5)  M0-  07.  J5.  C7.  F52
             Q5)  H0-  07.  M5.  C7.  A52
             H!5  E-5  H.7  R.2  L.7  >!!
             H!5  A-5  H.7  M.2  L.7  >!!

[illegible]  J!.  L!.  C!.  J5.  H73  HE.
             H!.  L!.  C!.  J5.  K73  FC.
             J!.  O!.  H!0  M5.  H73  FC0
             M!.  L!.  F!0  M5.  K73  EA0
             R!!  H!!  E!$  R.2  E<5  EA$
             M!!  L!!  C!$  R.2  H<5  C@$

[illegible]  K95  HE5  H!3  H40  J!.  J2.
             K95  HE5  K!3  C40  O!.  F2.
             H95  EH!  O!3  H40  M!0  M2.
             H95  EH!  K!3  L40  Q!0  J2.
             E!!  HE5  H!5  O!!  L!$  R!!
             E!!  HE!  E!5  L!!  O!$  M!!

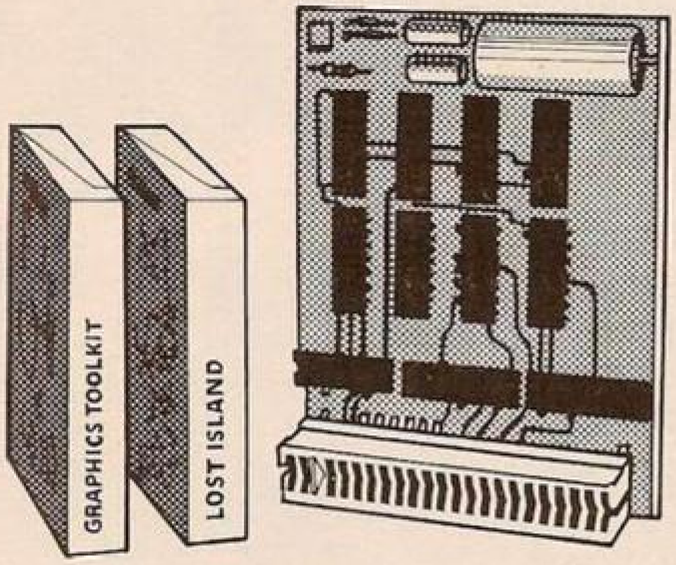
[illegible]  T40  M5-  M0-  M!5  F!2  E!)
             T40  M5-  L0-  J!5  A!2  E!)
             040  05-  M-0  H!)  F!2  H!)
             L40  M5-  0-0  E!)  J!2  H!)
             H.4  H!!  H5-  A!!  M!F  M!!
             C.4  H!!  H5-  A!!  J!.  M!!

[illegible]  00-  JF5  H5-  CC.  L0.  LC$
             M0-  JF5  H5-  JC.  L0.  HC0
             L-0  HE)  M5-  HE0  L0.  L!/
             H-0  EA)  H5-  FC0  M0.  L!0
             H5-  AE!  E!!  EA$  00.  L!.
             H5-  AE!  H!!  C@$  00.  L!0

[illegible]  H!-  C4.  H5-  F2.  M0-  H!3
             Q!-  C4.  J5-  F2.  M0-  K!3
             M!-  C.4  K5-  A2.  H0-  C!3
             Q!-  H.4  H5-  A2.  E0-  H!3
```

(listing continued on page 59)

16K ECONOPAK



16K ECONOTECH RAM **AND** GRAPHICS TOOLKIT
plus either LOST ISLAND **or** GAMES TAPE II
SAVE £7.35! Total package price only £24.50

JRS SOFTWARE

19 WAYSIDE AVENUE, WORTHING, SUSSEX. BN13 3JU Telephone: (0903) 65691

ZX81

Hardware

Econotech 16K RAM (uncased)	Only £20.95
JRS 16K RAM	Only £26.50
JRS 64K RAM	Only £62.95

Software

Programmers Toolkit (16K)	Only £4.95
Graphics Toolkit (16K)	Only £5.95
Lost Island (16K)	Only £4.95
Games Tape II (16K)	Only £4.95
Battleships (16K)	Only £4.95

SPECTRUM

A full range of software and hardware are available. Tick the coupon below for your free 1983 catalogue and enclose a large stamped addressed envelope.

I wish to order the following:

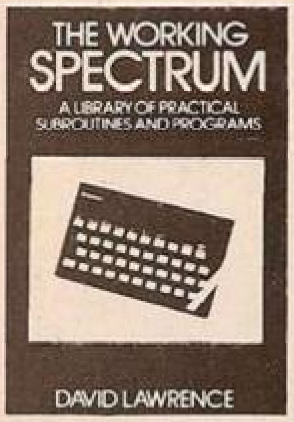
☐ 16K Budget Pak with Battleships	Only £27.75
☐ 16K Budget Pak with Games Tape II	Only £27.75
☐ Econotech 16K RAM	Only £20.95
☐ JRS 16K RAM	Only £26.50
☐ JRS 64K RAM	Only £62.95
☐ Programmers Toolkit (16K)	Only £4.95
☐ Graphics Toolkit (16K)	Only £5.95
☐ Lost Island (16K)	Only £4.95
☐ Games Tape II (16K)	Only £4.95
☐ Battleships (16k)	Only £4.95
☐ 1983 JRS Catalogue	Free

Tick as applicable Total (Including VAT & P&P) ______

Name .... Age ....

Address ....

Post to: JRS SOFTWARE, Department YC3
19 Wayside Avenue, Worthing, Sussex BN13 3JU



The Working Spectrum

(228 page book)
The first well-documented collection of serious programs for the ZX Spectrum. Programs include a Basic Renumber which can handle Gotos and Gosubs, a character dictionary, a file-handler, several utility programs and a few games. Each program is built up out of re-usable subroutines.

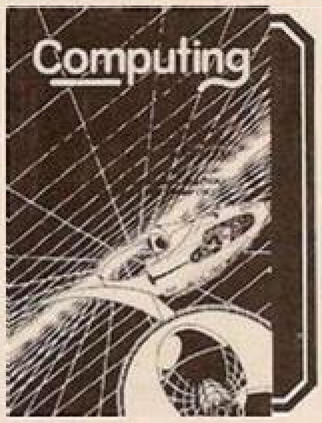
£5.95



The Working Dragon 32

This is a companion volume to The Working Spectrum and includes several new features such as a Text Editor and a Music Composer and Editor. Other programs help you use the Dragon 32 as an accountant, for more advanced high resolution graphics, as a home tutor for education and for playing games. Each of the programs and subroutines is explained line by line to help develop your own programming skills.

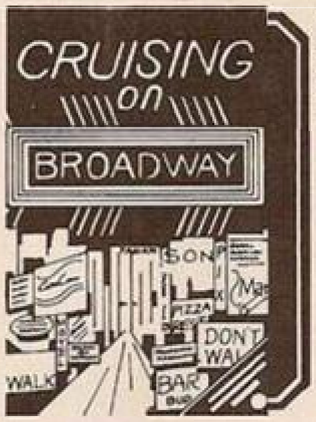
£5.95



Best of Popular Computing Weekly

Cassette
Four of the top Spectrum and ZX81 games from Popular Computing Weekly are recorded on this one cassette. The games are Laserchase for the 16K & 48K Spectrum, Kong's Revenge for the 16K & 48K Spectrum, Robot Control for the 16K ZX81 and Alien Attack, a Space Invaders type game for the 1K ZX81.

£4.45



Cruising (on Broadway)

cassette
Play Cruising, a new, fast, machine code game of skill for the 16K or 48K ZX Spectrum computer. You won't be able to beat it – the more you practice the faster it gets. Cash prizes are being offered for the highest recorded scores. See Popular Computing Weekly every Thursday for details.

£4.95

Please send me

Qty:

☐ **The Working Spectrum** at £5.95 each
☐ **The Working Dragon 32** at £5.95 each
☐ **Best of Popular Computing Weekly** at £4.45 each
☐ **Cruising (on Broadway)** at £4.95 each

I enclose a cheque/postal order for

£

payable to

Sunshine Books Ltd.
19 Whitcomb Street,
London WC2 7HF

Name

Address

Signed

We can normally deliver in four to five days.

A New Range From Sunshine Books Ltd

(continued from page 57)

the beginning of a tape by typing:

SAVE "MINUETZ"LINE 1

This allows it to AutoRun on loading, Line 1 fetching the tables and machine code from their final position on the tape immediately following the Basic.

Second, the bar table, figure 2, embodies the main data bank of the program, holding Mozart's 176 bars. 18 bytes of RAM are used to store the information for one bar. Since all of them are in three-eight time, and since the shortest note used was a semiquaver, the obvious time-slot of a sixth of a bar was chosen as the building block of the music. There is, in fact, one byte per channel per time slot. Figure 2 reveals something of the identity of the data by grouping them in bar "dominoes", with one time slot occupying a single domino row.

Using ASCII characters to represent the bytes has allowed a very compact table with a meaningful appearance and easy points of entry. Use the routine given at the end of figure 2 to enter the data. It mimics the printed listing on the screen as the bytes — in the form of strings — are entered, and allows you to start at any row of dominoes. If you wish to save the code at some stage prior to having entered it completely, type:

SAVE "MINUETZCODE"CODE 28930,3642

Before entering any code at all, always type Clear 28929. To continue with a half-entered table, type Clear 28929, Load in the code from tape, and again use the routine at the foot of figure 2, returning the appropriate bar to the prompt.

Third the machine-code routines and tables — figure 3. Having completed the bar table and Saved it on tape, type in the little loader at the end of figure 3. Type Clear 28929, and Load in the bar table, since the material in figure 3 will be part of the same 3,642-byte block of RAM. Run the figure 3 loader, and enter each block in turn, making sure you get the start address right, and of course, the number of bytes. The start address is the first address given under each block and the number of bytes is clearly marked.

Follow the same procedure used for figure 2 to save intermediate stages. Note that the figure 3 loader also mimics the layout of the printout on the screen to make checking of entries easier.

In the Basic program, lines 36-200 encompass the dice loop, generating the random numbers for the dice and drawing the dice themselves in their first two positions. But as you might imagine, there is a fair amount of work involved in drawing the dice. This could be handled only with the aid of machine code, which had the added advantage of economising on rapidly shrinking text-space. It may be of interest to point out that the final dice are drawn initially in "invisible" ink; this avoids flicker since the operation of converting the ink colour is a lot quicker than that of performing the calculations and drawing the dice with dots. Machine-code routines used are Dicemain, Drawdice and Prtdots, with their associated tables. Another subterfuge used for reasons of speed is that the monitor Circle routine is avoided.

Line 9890 — this short subroutine is called after the dice have been thrown to convert the

(continued on next page)

(listing continued from page 57)

```
      H!!  L7.  F!)  J!!  A-0  E!5
      H!!  L7.  E!)  J!!  A-0  H!5

[illegible] H@.  J!.  K!3  FA.  H!.  H!.
      H@.  R!.  H!3  FA-  C!.  G!.
      LH.  Q!0  C!3  J!.  L!.  H!.
      LH.  M!0  C!3  K!0  H!.  L!.
      OL.  O!$  E!5  J!2  O!!  O!!
      OL.  L!$  E!5  K!4  L!!  L!!

[illegible] M0-  F52  E!)  J!.  F2.  H@.
      Q0-  A52  E!)  M!.  E2.  H!!
      M0-  J52  H!)  H!0  F2.  H@.
      H0-  F52  E!)  F!0  J2.  H!!
      E!!  M!!  C!!  E!$  A.2  H@.
      A!!  M!!  A!!  C!$  F.2  H!!

[illegible] M0-  H!5  H!-  H95  F2.  M2.
      L0-  H!4  H!-  Q95  F2.  M2.
      M0-  A!5  E!-  M95  F2.  K2.
      H0-  A!0  E!-  H95  H2.  J2.
      E!!  A!-  A!!  E!!  J!!  H!!
      A!!  A!)  A!!  E!!  J!!  F!!

[illegible] J!.  E5)  K!3  A2.  J!5  O0-
      M!.  F5)  O!3  A5!  F!5  M0-
      H!0  H5)  C!3  F2.  E!)  O0-
      M!0  J5)  C!3  F5!  H!)  M0-
      C!$  K-5  E!5  J2.  M!!  H-0
      L!$  H-5  H!5  J5!  M!!  H-0

ENTER THE ABOVE TABLE USING THE
FOLLOWING ROUTINE.NOTE THAT EACH
DOMINO OF CHARACTERS REPRESENTS
ONE BAR,AND THAT THE CHARACTERS
ARE ENTERED AS 6,THREE-CHARACTER
STRINGS,TAKEN FROM ROWS 1 TO 6
OF THE DOMINO IN TURN
N.B. IF INVERTED COMMAS APPEAR
IN A STRING,SIMPLY TYPE THEM
TWICE,& THE COMPUTER WILL READ
IT AS ONE SET

   2 POKE 23658,12: CLS : INPUT
"STARTING BAR ? ",SB: LET P=2891
*2+SB*18
   4 FOR N=SB TO 133 STEP 6: PRI
NT INVERSE 1;N;: FOR B=0 TO 5: F
OR R=0 TO 5
   6 INPUT "3-CHAR STRING ";A$:
IF LEN A$<>3 THEN INPUT FLASH 1;
"ERROR:PRESS ENTER ";A$: GO TO 6
   8 FOR K=0 TO 2: POKE P+K+R*3+
B*18,CODE A$(K+1)-33: NEXT K: PR
INT AT 0+R,4+B*5;A$
  10 NEXT R: NEXT B: INPUT "NEXT
 SET OF 6 BARS (Y/N)? ";A$: IF A
$="Y" THEN LET P=P+108: CLS : NE
XT N
  12 STOP
```

Figure 3.

```
NOTETABLE (104 BYTES)

31414 0    0    148 6    42   6
31420 210  5    126 5    47   5
31426 229  4    158 4    92   4
31432 29   4    226 3    171  3
31438 118  3    68  3    21   3
31444 233  2    191 2    152  2
31450 114  2    79  2    46   2
31456 15   2    241 1    213  1
31462 177  1    162 1    139  1
31468 116  1    96  1    76   1
31474 57   1    40  1    23   1
31480 7    1    249 0    235  0
31486 221  0    209 0    197  0
31492 186  0    176 0    166  0
31498 157  0    148 0    140  0
31504 132  0    126 0    117  0
31510 111  0    105 0    99   0
31516 93   0

DICETABLES (176 BYTES)

31518 21   6    62   36   66   85
31524 39   96   34   3    12   21
31530 6    62   16   66   85   39
31536 47   112  75   12   111  102
31542 123  91   127  25   134  92
31548 38   129  10   37   56   13
31554 73   41   131  49   46   122
31560 54   84   86   115  119  126
31566 71   120  81   110  67   107
31572 26   99   42   50   2    80
31578 61   105  74   103  43   33
31584 11   106  90   124  32   95
31590 20   133  55   116  87   5
31596 29   5    29   5    29   5
31602 29   5    29   5    63   94
31608 59   78   23   108  13   97
31614 58   83   31   98   35   109
31620 138  113  64   121  76   69
31626 4    19   24   101  14   7
31632 57   118  45   44   18   28
31638 88   9    51   104  30   100
31644 27   137  130  72   128  79
31650 45   136  52   60   68   82
31656 39   47   34   53   12   45
31662 17   52   125  66   62   132
31668 47   34   53   12   89   93
31674 114  48   1    22   77   65
31680 117  135  40   8    8    8
31686 8    8    8    8    70   70
31692 70   8

DRAWDICEDATA1 (252 BYTES)

31694 17   26   16   31   18   21
31700 16   31   17   26   18   21
31706 16   31   20   27   18   21
31712 14   25   16   31   20   27
31718 18   21   14   25   17   26
31724 16   31   18   29   20   27
31730 18   21   16   23   14   25
31736 11   29   10   32   11   26
31742 10   32   11   29   11   26
31748 10   32   14   32   11   26
31754 7    26   10   32   14   32
31760 11   26   7    26   11   29
31766 10   32   12   32   14   32
31772 11   26   9    26   7    26
31778 12   22   8    24   16   20
31784 8    24   16   20   12   22
31790 8    24   12   24   16   20
31796 12   20   8    24   12   24
31802 16   20   12   20   12   22
31808 8    24   10   24   12   24
31814 16   20   14   20   12   20
31820 14   9    13   14   15   4
31826 13   14   14   9    15   4
31832 13   14   17   10   15   4
31838 11   8    13   14   17   10
31844 15   4    11   8    14   9
31850 13   14   15   12   17   10
31856 15   4    13   6    11   8
31862 8    12   7    15   8    9
31868 7    15   8    9    8    12
31874 7    15   11   15   8    9
31880 4    9    7    15   11   15
31886 8    9    4    9    8    12
31892 7    15   9    15   11   15
31898 8    9    6    9    4    9
31904 9    5    5    7    13   3
31910 5    7    13   3    9    5
31916 5    7    9    7    13   3
31922 9    3    5    7    9    7
31928 13   3    9    3    9    5
31934 5    7    7    7    9    7
31940 13   3    11   3    9    3

DRAWDICEDATA2 (12 BYTES)

31946 5    4    6    3    6    5
31952 5    1    5    6    4    1

DRAWDICEDATA3 (40 BYTES)

31958 47   45   1    1    65   22
31964 1    255  47   47   255  255
31970 65   24   255  1    0    55
31976 0    255  65   25   1    255
31982 0    55   0    1    0    55
31988 0    255  45   45   1    1
31994 0    55   0    1

DICEMAIN (102 BYTES)

31998 253  54   85   0    33   206
32004 123  58   159  125  6    2
32010 197  229  245  205  129  125
32016 17   42   0    241  225  25
32022 229  17   200  124  19   19
32028 61   32   251  26   213  205
32034 129  125  209  19   26   17
32040 42   0    225  25   229  213
32046 205  129  125  209  225  25
32052 58   160  125  193  16   208
32058 33   140  80   34   135  92
32064 205  100  125  33   4    104
32070 34   125  92   205  100  125
32076 253  54   85   7    33   0
32082 88   1    192  2    126  254
32088 0    32   2    54   7    11
32094 35   120  177  32   243  201

DRAWDICE (29 BYTES)

32100 217  229  217  6    10   33
32106 214  124  197  78   35   70
32112 35   94   35   86   35   229
32118 205  186  36   225  193  16
32124 239  217  225  217  201

PRTDOTS (30 BYTES)

32129 71   197  175  87   95   131
32135 28   28   16   251  95   25
32141 193  197  70   35   78   35
32147 229  205  217  13   62   111
32153 215  225  193  16   240  201

NATTABLE (51 BYTES)

32225 1    1    2    2    3    4
32231 4    5    5    6    6    7
32237 8    8    9    9    10   11
32243 11   12   12   13   13   14
32249 15   15   16   16   17   18
32255 18   19   19   20   20   21
32261 22   22   23   23   24   25
32267 25   26   26   27   27   28
32273 29   29   30

NOTESORT (74 BYTES)

32276 17   161  125  213  33   209
32282 125  6    8    197  70   35
32288 229  213  33   240  112  17
32294 18   0    25   16   253  209
32300 6    6    126  35   35   35
32306 18   19   16   248  225  193
32312 16   227  225  6    48   197
32318 126  6    51   184  40   6
32324 16   251  175  119  24   15
32330 17   224  125  19   16   253
32336 26   119  27   26   190  32
32342 2    203  254  35   193  16
32348 224  201

PLAYMAIN (77 BYTES)

32350 6    2    197  197  6    6
32356 17   209  125  197  26   19
32362 213  71   33   0    0    17
32368 18   0    25   16   253  1
32374 240  112  167  9    6    6
32380 197  205  171  126  6    121
32386 14   255  13   32   253  16
32392 249  193  16   240  209  193
32398 16   215  6    20   14   255
32404 13   32   253  16   249  193
32410 16   197  33   101  126  54
32416 217  193  16   3    54   209
32422 201  197  4    24   182

PLAYSLOT (38 BYTES)

32427 175  245  211  221  175  190
32433 32   6    205  209  126  175
32439 24   14   70   17   182  122
32445 19   19   16   252  26   19
32451 205  209  126  26   205  209
32457 126  35   241  254  6    200
32463 24   219

OUT (22 BYTES)

32465 6    1    16   254  211  223
32471 6    1    16   254  193  241
```

(listing continued on next page)

(continued from previous page)

dice numbers into equivalent bar numbers.

Lines 9916-9925 draw the blank manuscript, and lines 8530-8775 — see figure 6 — actually print out the music. Each voice is printed out in full before moving on to the next voice. The appropriate data is fetched from the bar table by the machine-code routine Notesort. Lines 8771-8775 actually print the notes, U being a flag to determine the direction in which the tails are drawn, Z being another flag indicating whether leger lines are required.

Line 9900 is a subroutine to print out the record of dice numbers.

Lines 9800-9835 play the music. The PSG is initialised in Basic before calling the machine code which actually outputs the music. The first entry point to the subroutine is at line 9830, the routine re-entering itself from line 9800 if a repeat is desired. Which machine-code routines are called depends on whether a PSGIO board is connected. If it is then Playmain is called, which in turn uses Playslot and Out. If no soundboard is detected then Musicbox is called, which simulates a musical box playing through the top voice only; even the clicks of the wards are included. Seriously though, the Musicbox routines — including Part and Beepout — are really only intended to verify the software as a whole if you have not yet got hold of a PSGIO board, and though fun, is no substitute for the real, three-voice original. On the PSGIO board, an output socket is provided to allow you to plug into the Aux input of your amplifier: this arrangement really does justice to the music.

Lines 207-253 call the manuscript drawing and play subroutines when required, and handle Saving of manuscript, as well as setting up volume and tempo variables.

Line 253 changes key each cycle, according to the factor KY.

Finally, a note on I/O: the two registers, 14 and 15 in the PSG give 16 bits of TTL-compatible I/O capability to the PSGIO circuit. As pointed out earlier, the ports can be driven completely independently of the sound generation; while sound is being output, I/O operations can be performed. The ports are bidirectional. Bits 6 and 7 of register 7 are used to dictate which direction is operational for each port; if either is set to one then the corresponding port is in output mode, if a zero setting, then the port is in input mode. The possibilities are endless.

There is nothing to stop anyone substituting his own bars for the Mozart using the information given in the text, and with the limitations that with the current arrangement only triple-time music can be accommodated.

Those familiar with machine code should find it relatively easy to cope with duple times by changing the number of slots and the cycle counters which handle them.

Some programmers will be unwilling or unable to deal with the effort of punching in the whole of Minuetż, or building the programmable sound generator and input/output board. If they wish, they may write to Rod Hopkins at 5 Greenside, Leslie, Fife KY6 3DD for a copy of the program at £3.25, or the fully-built PSGIO board together with the program for £19.75. Both prices include postage and packing.

(listing continued from previous page)

```
32477 60  211 221 245 197 6
32483 1   16  254 201

MUSICBOX  (25 BYTES)

32487 6   2   197 62  225 167
32493 214 8   16  252 50  25
32499 126 205 0   127 193 16
32505 239 62  209 50  25  126
32511 201

PART  (23 BYTES)

32512 33  59  126 54  201 229
32518 205 20  126 205 23  127
32524 6   255 16  254 205 23
32530 127 225 54  6   201

BEEPOUT  (36 BYTES)

32535 33  161 125 6   48  197
32541 229 239 52  126 47  0
32547 0   20  56  225 126 35
32553 254 0   32  2   62  69
32559 229 205 40  45  205 248
32565 3   225 193 16  226 201


ENTER EACH OF THE ABOVE DUMPS IN
 TURN USING THE FOLLOWING ROUT-
INE. IN EACH CASE THE START
ADDRESS IS THE FIRST ADDRESS
SHOWN FOR THAT DUMP


   2 INPUT "NUMBER OF BYTES ? ";
B: INPUT "START ADDRESS ? ";S
   4 FOR N=S TO S+B-1 STEP 6: PR
INT N;: FOR K=0 TO 5
   6 INPUT "NEXT BYTE ? ";A: POK
E N+K,A: PRINT TAB 6+K*4;A;: IF
N+K=S+B-1 THEN GO TO 10
   8 NEXT K: PRINT : NEXT N
  10 STOP
```

Figure 4.

```
MACHINE CODE DISSASSEMBLY

"DICEMAIN"
INKOFF      LD(ATT-T),0
            LD HL,DATA1
            LD A,(LHDICENO)
            LD B,DICE COUNT
NXTDICE     PUSH BC
            PUSH HL
            PUSH AF
PRTOPFACE   CALL PRTDOTS
            LD DE,FACESTEP
            POP AF
            POP HL
            ADD HL,DE
            PUSH HL
            LD DE,DATA2-2
VALIDNUM    INC DE
            INC DE
            DEC A
            JRNZ VALIDNUM
            LD A,(DE)
            PUSH DE
PRTLHFACE   CALL PRTDOTS
            POP DE
            INC DE
            LD A,(DE)
            LD DE,FACESTEP
            POP HL
            ADD HL,DE
            PUSH HL
            PUSH DE
PRTRHFACE   CALL PRTDOTS
            POP DE
            POP HL
            ADD HL,DE
            LD A,(RHDICENO
            POP BC
            DJNZ NXTDICE
DRAWCUBES   LD HL,RHPLOTCORDS
            LD(PLOTXY),HL
            CALL DRAWDICE
            LD HL,LHPLOTCORDS
            LD(PLOTXY),HL
            CALL DRAWDICE
INKON       LD(ATT-T),7
            LD HL,ATT-FILE
            LD BC,SCRNSIZE
NXTPOSN     LD A,(HL)
            CP INK0
            JRNZ DONE?
            LD(HL),INK7
DONE?       DEC BC
            INC HL
            LD A,B
            OR C
            JRNZ NXTPOSN
            RET

"DRAWDICE"
SAVERET     EXX
            PUSH HL
            EXX
            LD B,SIDECOUNT
            LD HL,DATA3
NXTSIDE     PUSH BC
            LD C,(HL)
            INC HL
            LD B,(HL)
            INC HL
            LD E,(HL)
            INC HL
            LD D,(HL)
            INC HL
            PUSH HL
            CALL DRAW
            POP HL
            POP BC
            DJNZ NXTSIDE
UNSTKRET    EXX
            POP HL
            EXX
            RET

"PRTDOTS"
GETNUM      LD B,A
            PUSH BC
            XOR A
            LD D,A
            LD E,A
GETDOTPAT   ADD A,E
            INC E
            INC E
            DJNZ GETDOTPAT
            LD E,A
            ADD HL,DE
            POP BC
NXTDOT      PUSH BC
            LD B,(HL)
            INC HL
            LD C,(HL)
            INC HL
            PUSH HL
            CALL SETPRTPOS
            LD A,CODE "o"
PRTDOT      RST 10H
            POP HL
            POP BC
            DJNZ NXTDOT
            RET

"NOTESORT"
            LD DE,VOICESTO
            PUSH DE
            LD HL,RNDTABLE
            LD B,BARCOUNT
NXTBAR      PUSH BC
            LD B,(HL)
            INC HL
            PUSH HL
            PUSH DE
            LD HL,BARTABLE-16
            LD DE,BARSTEP
GETBAR      ADD HL,DE
            DJNZ GETBAR
            POP DE
            LD B,SLOTCOUNT
NXTSLOT     LD A,(HL)
            INC HL
            INC HL
            INC HL
            LD (DE),A
            INC DE
            DJNZ NXTSLOT
            POP HL
            POP BC
            DJNZ NXTBAR
            POP HL
            LD B,BARS*SLOTS
NXTSLOT     PUSH BC
            LD A,(HL)
            LD B,TOPNOTE
NOTE?       CP B
            JRZ NATEQUIV
            DJNZ NOTE?
            LD A,B
            LD(HL),A
            JR PTNXTSLOT
NATEQUIV    LD DE,NATTABLE-1
GETNAT      INC DE
            DJNZ CALCNAT
            LD A,(DE)
            LD(HL),A
            DEC DE
            LD A,(DE)
            CP (HL)
            JRNZ PTNXTSLOT
            SET 7,(HL)
PTNXTSLOT   INC HL
            POP BC
            DJNZ NXTSLOT
            RET

"PLAYMAIN"
            LD B,PARTCOUNT
            PUSH BC
REPEAT      PUSH BC
            LD B,BARCOUNT
            LD DE,RNDTABLE
NXTBAR      PUSH BC
            LD A,(DE)
            INC DE
            PUSH DE
            LD B,A
            LD HL,0
            LD DE,16
CALCBAR     ADD HL,DE
            DJNZ CALCBAR
            LD BC,BARTABLE-16
            AND A
            ADD HL,BC
            LD B,SLOTCOUNT
NXTSLOT     PUSH BC
            CALL PLAYSLOT
            LD B,COUNT1
LOOP1       LD C,COUNT2
LOOP2       DEC C
            JRNZ LOOP2
            DJNZ LOOP1
            POP BC
            DJNZ NXTSLOT
            POP DE
            POP BC
            DJNZ NXTBAR
            LD B,COUNT1
LOOP3       LD C,COUNT2
LOOP4       DEC C
            JRNZ LOOP4
            DJNZ LOOP3
            POP BC
            DJNZ REPEAT
            LD HL,RANDTABPOINT
            LD (HL),PART2POINT
            POP BC
            DJNZ REPEAT2
            LD (HL),PART1POINT
            RET
REPEAT2     PUSH BC
            INC B
            JR REPEAT

"PLAYSLOT"
            XOR A
NXTVOICE    PUSH AF
            OUT REGADDR,A
            XOR A
            CP (HL)
            JRNZ GETNOTE
            CALL OUT
            XOR A
            JR HIOUT
            LD B,(HL)
```

```
            LD DE,NOTETABLE-2
CALCNOTE    INC DE
            INC DE
            DJNZ CALCNOTE
            LD A,(DE)
            INC DE
            CALL OUT
            LD A,(DE)
HIOUT       CALL OUT
            INC HL
            POP AF
            CP 6
            RET Z
            JR NXTVOICE

"OUT"

            LD B,COUNT
LOOP1       DJNZ LOOP1
            OUT 223,A
            LD B,COUNT
LOOP2       DJNZ LOOP2
            POP BC
            POP AF
            INC A
            OUT 221,A
            PUSH AF
            PUSH BC
            LD B,COUNT
LOOP3       DJNZ LOOP3
            RET

"MUSIC BOX"

            LD B,2
NXTPART     PUSH BC
            LD A,255
            AND A
GETPART     SUB 6
            DJNZ GETPART
            LD(RNDTABLO),A
            CALL PART
            POP BC
            DJNZ NXTPART
            LD A,RNDTLO
            LD(RNDTABLO),A
            RET
"PART"

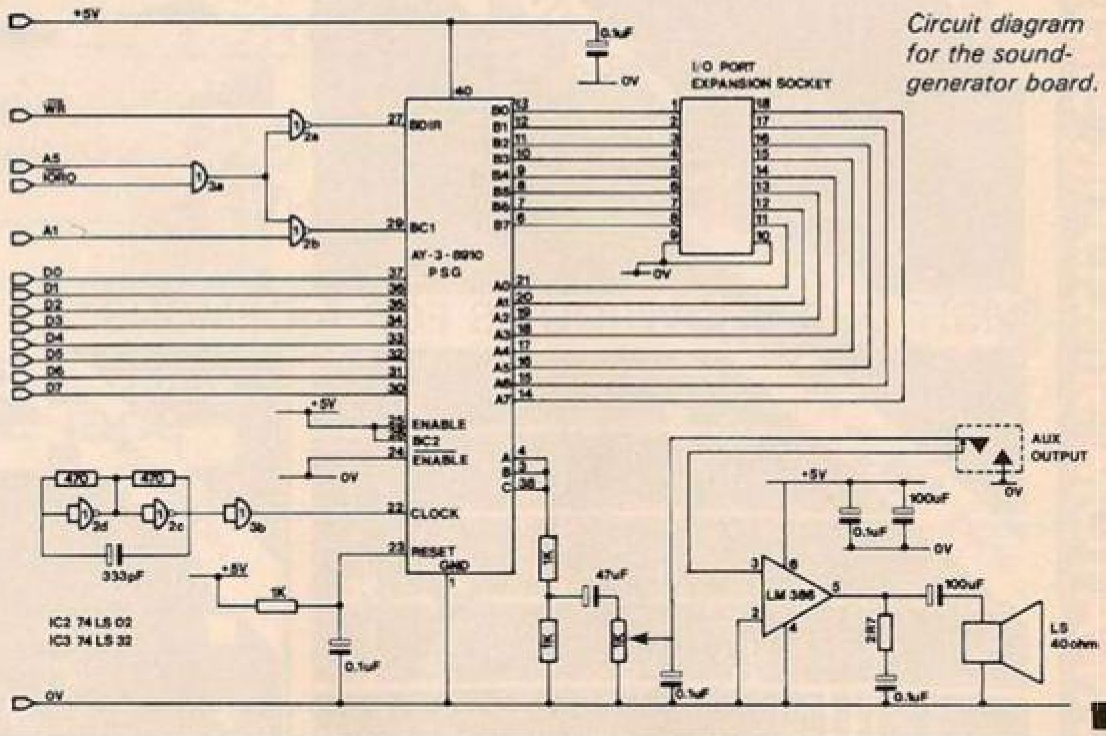
            LD HL,NOTESORTEND
            LD(HL),RET
            PUSH HL
            CALL NOTESORT
            CALL BEEPOUT
            LD B,COUNT
LOOP1       DJNZ LOOP1
            CALL BEEPOUT
            POP HL
            LD(HL),"LD,B"
            RET
"BEEPOUT"

            LD HL,VOICESTO
            LD B,SLOTS
NXTSLOT     PUSH BC
            PUSH HL
            RST 28H
            DEFB
            DEFB
            DEFB
            DEFB
            DEFB
            DEFB
            DEFB
            POP HL
            LD A,(HL)
            INC HL
            CP NONOTE
            JRNZ NOTE
            LD A,NONOTE
NOTE        PUSH HL
            CALL STKACC
            CALL ROMBEEP
            POP HL
            POP BC
            DJNZ NXTSLOT
            RET
```

Figure 5.

RAM ALLOCATIONS ABOVE RAMTOP

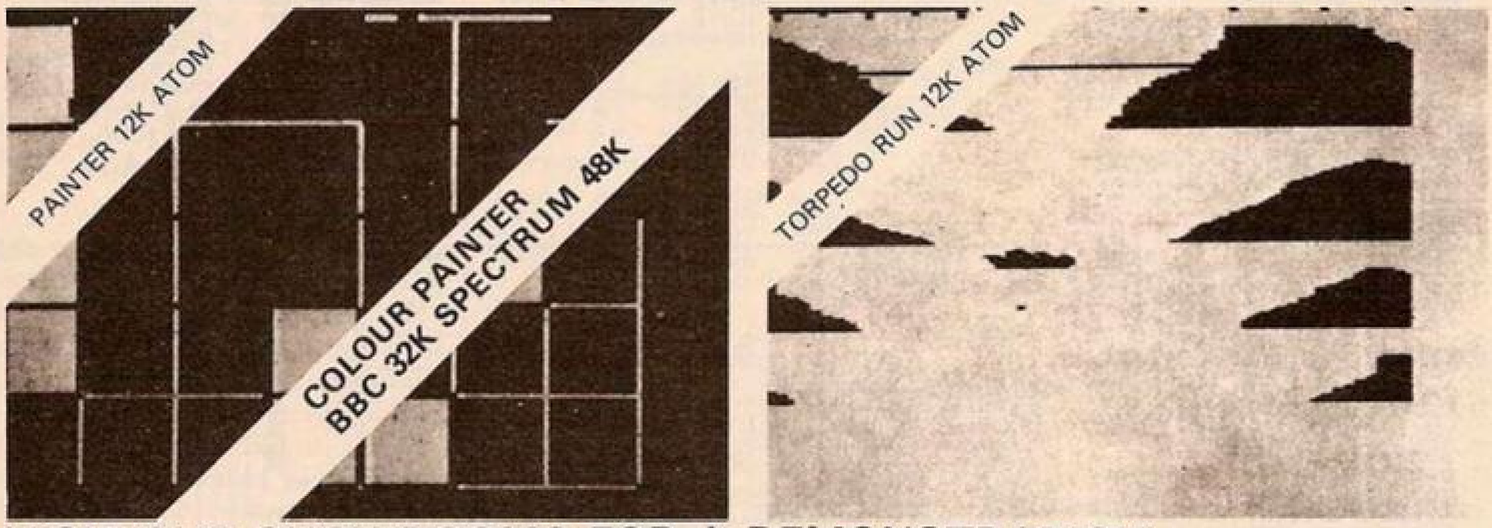
28930-31413	BARTABLE
31414-31517	NOTETABLE
31518-31693	DICETABLES
31694-31997	DRAWDICEDATA
31998-32099	DICEMAIN
32100-32128	DRAWDICE
32129-32158	PRTDOTS
32159-32160	DICENOSTO
32161-32208	VOICESTO
32209-32224	RNDTAB
32225-32275	NATTABLE
32276-32349	NOTESORT
32350-32426	PLAYMAIN
32247-32464	PLAYSLOT
32465-32486	OUT
32487-32511	MUSICBOX
32512-32534	PART
32535-32570	BEEPOUT



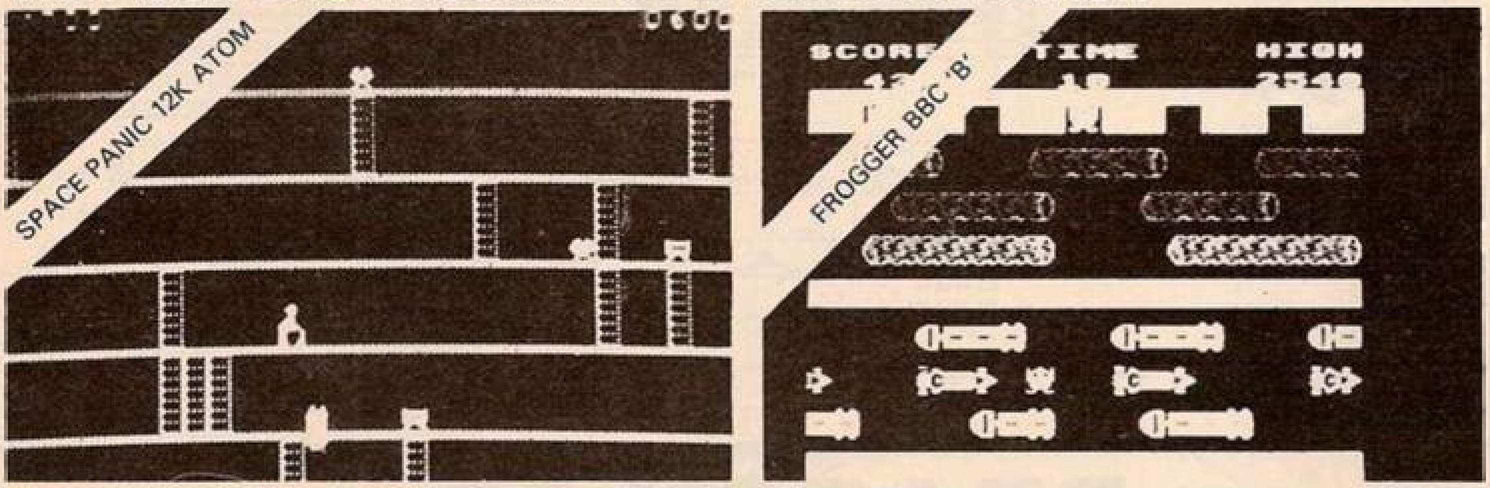
Circuit diagram for the sound-generator board.

A+F SOFTWARE A+F

BBC 32K £8.00 PAINTER SPECTRUM 48K £7.00



VISIT OUR SHOWROOMS FOR A DEMONSTRATION



ATOM
Torpedo Run
Cylon Attack
Space Panic
Painter
Zodiac
Death Satellite
£6.90

SPECTRUM 48K
Painter
Frogger
£7.00

DRAGON
Deadwood £6.90

BBC

Model 'A'	
Tower of Alos	£6.90
Model 'B'	
Tower of Alos	£6.90
Planes	
Painter	£8.00
Pharoh's Tomb	
Frogger	

****

Price £8.00
New Release

PLANES

BBC 32K
Arcade Game

****

ATOM 'TOOLKIT' EPROM
22 Extra Commands and Five features including 1200 Band Cass. Operating System £18.50

ADD 4 or 6 EPROMS
TO YOUR ATOM WITH OUR 'ADDA' BOARDS
6-Way 'Adda' board £28.75

5% DISCOUNT ON ALL SOFTWARE WITH THIS COUPON
(Quote '830/ 1' for discount on telephone orders)

NAME____________________ PLEASE SEND ME:
ADDRESS____________________

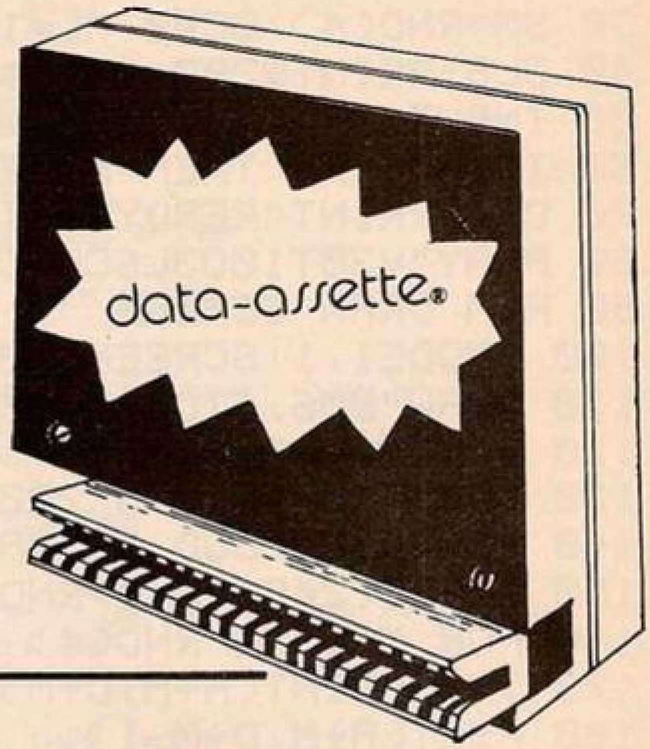
Please note prices include post & packing
You may also telephone (24 hrs) with credit card order

830 HYDE ROAD MANCHESTER M18 7JD
061-223 6206 (24 hrs) Telex 667461 (AHn A&F)

SINCLAIR SIRIUS SPECTRUM BBC DRAGON ATOM SINCLAIR SIRIUS SPECTRUM
BBC DRAGON ATOM SINCLAIR SIRIUS SPECTRUM BBC DRAGON ATOM SIN
CLAIR SIRIUS SPECTRUM BBC DRAGON ATOM S

NEW RELEASES

RAM PACKS



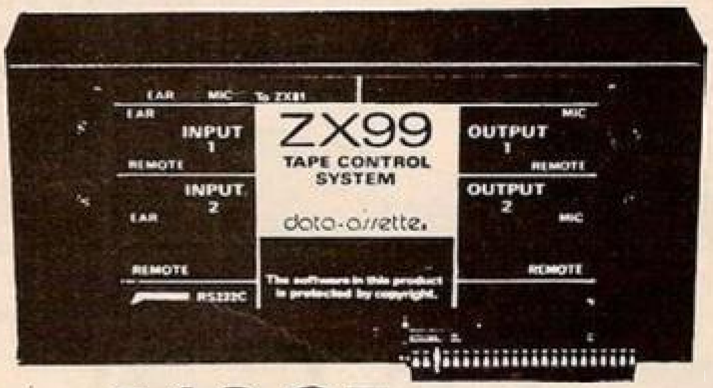
British made, high quality, add-on memory at affordable prices. Fully guaranteed.

16k Ram Pack ———— **£28·95**

16k Expandable internally by plug-in module to full 32k **£29·95**

Expansion module ———— **£17·95**

ZX99 Automatic Tape Controller for Sinclair ZX81



£49·95 plus £2·95 P&P

- DATA PROCESSING – software control of up to four tape recorders
- RS232C INTERFACE – allowing connection with any such printer using the full ASCII character code
- AUTOMATIC TAPE COPY – copy a data file regardless of your memory capacity
- TAPE BLOCK SKIP – without destroying the contents of RAM
- ZX99 SOFTWARE AVAILABLE

Contact us for details of all personal computing accessories and a full range of software including Quantec

Distributors of KAYDE products

data-assette®

44, Shroton Street
London NW1
Telephone (01) 258 0409

Computer Cassettes

High quality, AGFA tape, screw assembled cassettes with library boxes

c5–37p	c10–39p	c12–40p
c15–41p	c20–43p	c25–45p
	c30–46p	

Cassette Leads

BBC1	7pin to 2x3·5mm, 1x2·5mm	£2
BBC2	7pin to 5pin & 1x2·5mm	£2·50
DRAGON	5pin to 2x3·5mm, 1x2·5mm	£2

Cassette Workshop

E801	FIXOTAPE – Semi-automatic, frees twisted tape in seconds	£1·99
E612	Index cards	50p for 12
ECO1	Blank white labels	40p for 15
ECO2	" " on tractor paper	£3·99 for 100
CSS1	Revolving storage rack (holds 32 tapes or 20 in cases)	£2·99
CSS2	Double revolving storage rack (holds 64 tapes or 40 in cases)	£5·99

ORDER FORM — Dept. CY1 Data-Assette, 44 Shroton Street, London NW1

ITEM	NO.	PRICE	TOTAL

P&P 10% (min. charge £1.50)

Charge my Access/Visa no: ______

Signed ______ Name ______

Address ______

```
10 REM MAGGOTS (C) M.PERCY JAN'83
20 CLEAR 2000:X=128:Y=96:I=128:O=96
30 SM=RND(4):SC=0:ML=10
40 CLS:PRINT@200,"maggots"
50 INPUT "FAST OR SLOW(F/S)";S$
60 IF S$="F" THEN POKE &HFFD7,0
70 CLS:PRINT"READY!!";
80 PLAY"V30T10O3L6CL3O2GGL2EEL1CC":CLS
90 REM DRAW SCREEN
100 PMODE1,1:SCREEN1,0:PCLS2:COLOR4,2
110 DRAW"BM6,6;C4;R243D180L243U180"
120 PRINT(0,0),4,4
130 GOSUB 150:GOTO 220
140 REM PUT FOOD IN RANDOM POSITION
150 A=RND(240)+8:D=RND(178)+8
160 FOR M=1 TO RND(4)
170 IF PPOINT(A+M,D+M)=4 THEN 150
180 PSET(A+M,D+M,1)
190 SOUND 100,1
200 NEXT M
210 RETURN
220 REM MOVEMENT
230 ON SM GOTO 290,360,430,500
```

Fast and tricky, M Percy's Maggots will soon have you wriggling at the keyboard.

THIS ADDICTIVE high-resolution game for the Dragon 32 does wonders for the reflexes and gets away from the era of laborious games with a ready-set maze.

Due to the amazing speed with which the Dragon works in Basic, this game — in which a red maggot runs around the screen and searches for food — can be very hard. A speed option is offered: this is done by setting the internal timer to a running speed of 1.8 MHz instead of the default of 0.9 MHz.

The idea is to move the maggot — which starts off in a random direction, but always from the centre position — round the screen, to the clumps of food which are represented by green dots. Movement is achieved by the use of the arrow keys. When a clump of food is eaten the maggot increases by a length or two.

Turning should be kept to a minimum because the maggot sloughs its skin. If the maggot hits this or the border then the game is lost. As more and more corners are turned the screen fills up with red lines. The bigger the maggot the longer the barricade of dead skin will be.

When the maggot has reached a length of 40 the game stops for five seconds. The screen then clears and play starts again, but instead of starting off 10 segments long, it starts with two so that more epithelia will be descarded, making the game harder than before. When three sets have been cleared the internal timer is set to Fast mode so that the game, if started in Slow, will now be fast. The game then continues with a new set appearing each time the maggot attains a length of 40 units.

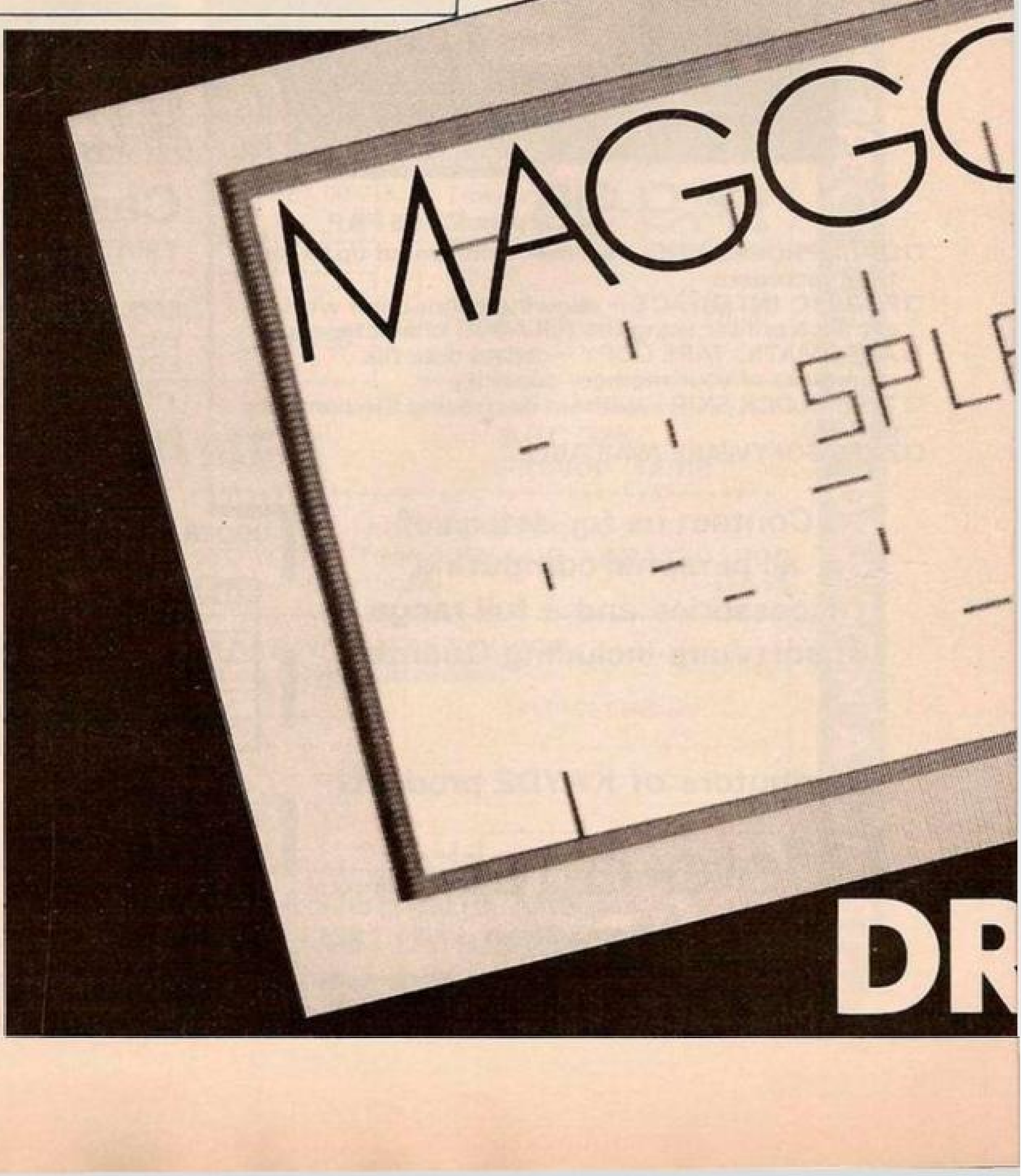
Due to the way the end of the maggot is preset to keep it at the length specified by ML and the variables I and O a skin or skin segment immediately behind the maggot may disappear. This will only happen when turning and may be used to an advantage to reach food which was inaccessible — but be careful that the food is not erased as well.

Lines 20-30 clear room for the strings and set all necessary variables; lines 50-60 determine speed; and lines 70-120 set display.

In line 130, the Gosub moves to the food routine: the Goto is for starting the game.

Lines 150-200 place a clump of food in a random position with line 170 checking to see if the point is already set to read, and if so starts the routine again. Up to four blocks of food may appear in one clump or as little as one — variable M determines this. Line 150 places the food in the yellow area of the screen only. Line 230 starts the maggot moving in the appropriate random direction by the variable SM, and goes to the appropriate line number; lines 240-280 send control to the appropriate line number, and line 290 checks to see if any of the arrow keys have been depressed.

If none has been depressed or if the reverse key has been pressed, then the maggot carries on moving in the same direction or else goes



back to lines 240-280 for the next direction.

Line 300 checks to see if the next point to be PSet is red and if so moves the losing routine at 580. Line 310 checks to see if the next point is food and if so goes to the appropriate routine.

Lines 330-350 subtract the length of the maggot from the PSet position and preset these points so that the maggot does not appear as one continuous line.

Line 590 speeds the routine up and 700 slows it back down. Lines 790-850 search for food in an area of three by three around the maggot's head and for each little block found five points are added to the score. Line 840 then presets these points so that no food is left in that area. Line 860 goes to the routine for placing some more food in another random position. Line 870 adds two to the length of the maggot. Line 880 checks to see if it is 40 in length and if so goes to the routine at 900.

Lines 900-950 clear the screen and add 1 to the amount of sets cleared. Line 940 makes the game fast if a fourth set is reached. Line 950 gives the maggot a length of two and continues the game. Variable ML can be changed in line 880 to make the game easier or harder.



(continued from facing page)

```
240 IF B$=CHR$(94) THEN 290
250 IF B$=CHR$(10) THEN 360
260 IF B$=CHR$(8) THEN 430
270 IF B$=CHR$(9) THEN 500
280 GOTO 240
290 B$=INKEY$:IF B$=CHR$(10) OR B$="" THEN Y=Y-2 ELSE 240
300 IF PPOINT(X,Y)=4 THEN 580
310 IF PPOINT(X,Y)=1 THEN GOSUB 780
320 PSET(X,Y,4)
330 I=X:O=Y+ML:IF O>184 THEN O=184
340 PRESET(I,O)
350 GOTO 290
360 B$=INKEY$:IF B$=CHR$(94) OR B$="" THEN Y=Y+2 ELSE 240
370 IF PPOINT(X,Y)=4 THEN 580
380 IF PPOINT(X,Y)=1 THEN GOSUB 780
390 PSET(X,Y,4)
400 I=X:O=Y-ML:IF O<8 THEN O=8
410 PRESET(I,O)
420 GOTO 360
430 B$=INKEY$:IF B$=CHR$(9) OR B$="" THEN X=X-2 ELSE 240
440 IF PPOINT(X,Y)=4 THEN 580
450 IF PPOINT(X,Y)=1 THEN GOSUB 780
460 PSET(X,Y,4)
470 I=X+ML:O=Y:IF I>242 THEN I=242
480 PRESET(I,O)
490 GOTO 430
500 B$=INKEY$:IF B$=CHR$(8) OR B$="" THEN X=X+2 ELSE 240
510 IF PPOINT(X,Y)=4 THEN 580
520 IF PPOINT(X,Y)=1 THEN GOSUB 780
530 PSET(X,Y,4)
540 I=X-ML:O=Y:IF I<8 THEN I=8
550 PRESET(I,O)
560 GOTO 500
570 REM PRINT SCORES
580 FOR Z=0 TO 250:NEXTZ
590 POKE &HFFD6,0
600 FOR C=1 TO 4
610 PLAY"V31T200O1CDECDECDE"
620 DRAW"C"+STR$(C)
630 DRAW"BM120,100;S8;R5U5L5U5R5"
640 DRAW"BM137,100;S8;U10R5D5L5"
650 DRAW"BM152,100;S8;NR5U10"
660 DRAW"BM166,100;S8;U10R5D10U5L5"
670 DRAW"BM180,100;S8;BR5U10NL5R5"
680 NEXT C
690 SOUND 1,20
700 POKE &HFFD6,0
710 FOR Z= 0 TO 100:NEXTZ
720 CLS:PRINT"YOUR BODY WAS";ML;"CMS LONG,"
730 PRINT"AND YOU SCORED";S;"POINTS."
740 PRINT"AND CLEARED";SC;"SETS"
750 INPUT"ANOTHER GO(Y/N)";B$
760 IF B$="N" THEN END
770 RUN
780 REM SEARCH FOR FOOD
790 FOR B=-2 TO 2
800 FOR V=-2 TO 2
810 IF PPOINT(B+X,V+Y)=1 THEN 820 ELSE 850
820 SOUND 230,1
830 S=S+5
840 PRESET(B+X,V+Y,2)
850 NEXT V,B
860 GOSUB 150
870 ML=ML+2
880 IF ML=40 THEN 900
890 RETURN
900 FOR Z=0 TO 600:NEXT Z
910 CLS:PRINT"ANOTHER SET COMING UP"
920 PLAY"V31O1DDDO2CDEFGO2CDEFG"
930 SC=SC+1
940 IF SC=3 THEN POKE &HFFD7,0
950 ML=2:GOTO 100
```

■

reprints

If you are interested in a particular article/special feature or advertisement in this journal

HAVE A GOOD LOOK AT OUR REPRINT SERVICE!

We ofter an excellent, reasonably priced service working to your own specifications to produce a valuable and prestigeous addition to your promotional material. (Minimum order 250 copies).
Telephone Michael Rogers on 01-661 3036 or complete and return the form below.

To: Michael Rogers, Your Computer, Reprint Department, Quadrant House, Sutton, Surrey SM2 5AS.

I am interested in ....copies of article/advert.

headed ....featured in this

journal on pages ...., issue dated ....

Please send me full details of your reprint service by return of post.

Name ....

Company ....

Address ....

..............................Tel No ....

VOLCANIC DUNGEON CHAMPIONSHIP

CARNELL SOFTWARE



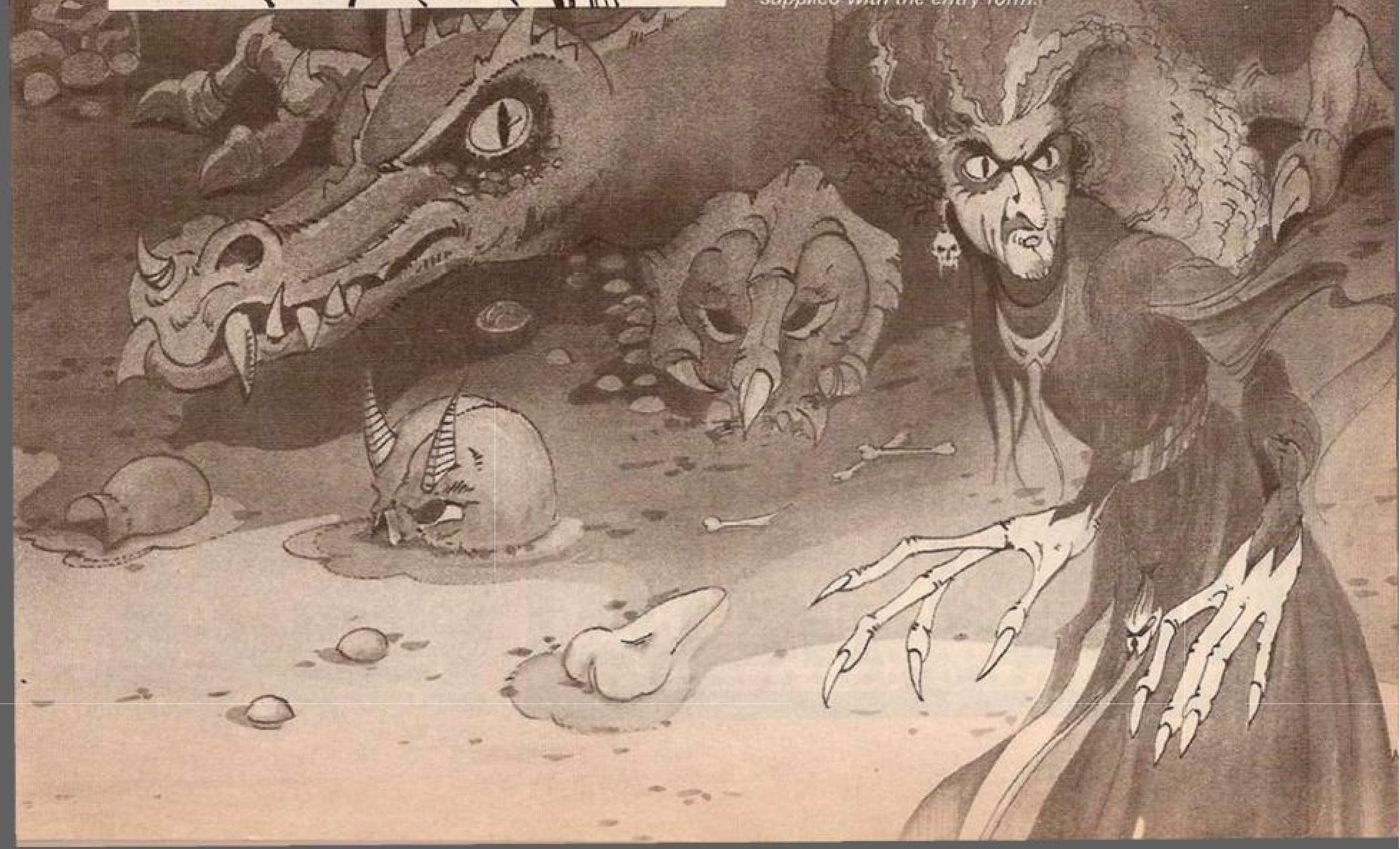
WIN A FABULOUS 'WINGS' HOLIDAY FOR 2 TO FLORIDA.

VISIT THE AMAZING NEW EPCOT CENTRE

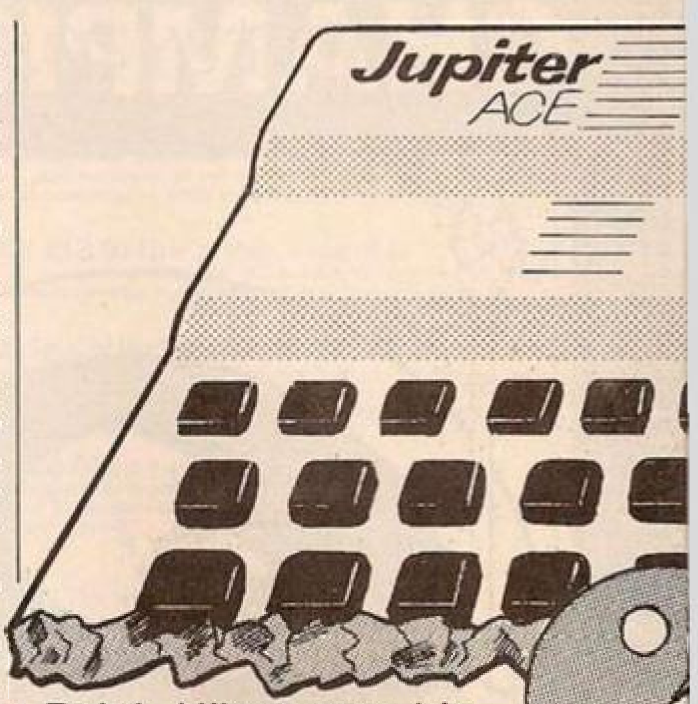
Volcanic Dungeon, the addictive adventure. People have been known to venture into its maze of caverns to rescue the Princess Edora again and again. If you are one of them, or wish to be, then you could find yourself lying on a **sun-drenched beach in Miami for a week. Followed by a further week at Orlando,** visiting **Disney World** and **Epcot.** So what do you have to do for all this? **Just be the best Volcanic Dungeon player in the UK, that's all!** Ten finalists will battle it out in the championship at the London Computer Fair, Earl's Court, in June 1983. **But first you must prove you are worthy.**

Volcanic Dungeon is available on the **16K ZX-81, 48K Spectrum and Dragon 32.** An entry form is supplied with every game. (Anyone who already owns the original ZX version can enter by sending a SAE for an entry form.) **Order your copy NOW** from **CARNELL SOFTWARE, 4 Staunton Road, Slough, Berks. Only £5.00** including P&P. **Also available from good microcomputer stores.**

The 'Judges' decision is final and no correspondence will be entered into. All business associates of Carnell Software, and their relatives, are disqualified from entry. A copy of the rules of the Volcanic Dungeon championship will be supplied with the entry form.



FORTH: ACE



Ralph Hilton gets his teeth into Forth games. Have an Ace munch.

WITH FORTH now available for home computers and the release of the Jupiter Ace, users suddenly have a machine and a language ideally structured to games that are fast, involved and without the relative complexity of machine code. Forth's compact programming means one can develop and test each of the elements of the whole program as one builds it up.

The disadvantage of not being able to code from the top down, as in Basic, is overcome easily by either flowcharting the proposed program or doing a simple logical list of its component parts.

The Jupiter Ace I used for this program has an actual memory availability for user Forth words of less than 1K. This may seem very little but it gives one sufficient space to create versions of popular arcade games that contain the main features of the originals and run very close to their speeds. In fact, I found that Pac-Man written in Forth actually runs faster than the game played at the local amusement centre. As it is one of the more popular games and contains many of the building blocks one would use in other games I chose it as the example for this article.

I have included all the main points of the arcade version, except for the power pills which would take up an extra 500 bytes at a rough estimate.

I have assumed that you understand the basic words used in the Ace but include an explanation of the specific techniques involved. To conserve memory the variables and words used have short names but I comment on each separately.

The sequence for the game is as follows. First, the graphics used for the man, ghosts, dots and wall are defined and the screen created. Next the variables are initialised and the man and ghosts placed in their starting positions.

The way the man moves is broken down into the following steps. First, a check to see if an appropriate key has been pressed, and the program continues with this sequence if it has.

The Inkey function on the Ace returns to the stack the ASCII value of the key pressed. This has to be converted into a number giving the change in position in the display file. The Ace display file is laid out in 24 rows of 32 columns, each at addresses 9216 to 9984. An up or down movement changes the memory location by 32 and a left or right movement changes it by 1. I have used these numbers to give the new location of the man.

Next the program checks to make sure the man does not bump into a wall and continues only if there is no risk of this.

Then a space is put in the man's last position, and the new position is checked to see whether or not it contains a dot. If it does, the score is incremented. If this score means that all the available dots have been eaten, the screen is refilled.

Now the man is moved to his new position which is stored in the appropriate variable. The ghost-moving section comes next. I found that this was most easily done by having a separate variable for each ghost's position which is put into the variable used by the subroutine as each ghost is moved.

The sequence for each ghost starts by checking whether the ghost should move up or down or neither according to the relative position of the man, and then makes sure that it does not hit a wall. A random generator is used to allow the ghost only limited movement — the game would be impossible if the ghost was always correct, and boring if its movement were fully predictable. When a ghost moves, the space it leaves is replaced with a space or dot as appropriate. This is done by a method which is explained fully in the actual coding. The same procedure is used for left and right movement of the ghost. If the man now occupies the same position as one of the ghosts the game ends.

Obviously all these procedures need additional subroutines to generate the random numbers and refill the screen with dots when required.

The game is loaded in three sections to make full use of the memory but no reloading is necessary to replay.

First, the graphics section is prepared. I have assigned user graphics for the wall and dots as this makes it far easier to type in the screen itself. The graphics are placed into a section of RAM which is calculated as starting at 11264 plus the ASCII code of the character one is defining multiplied by 8. As typing in a list of binary digits is tedious I have converted all the values to decimal.

Here is the listing for the graphics section:

```
: NM 36 126 219 90 126 255 126 36 ;
```

This word puts the values used for the ghost on to the stack. It is a separate word because it is needed several times.

```
: GR 8 * 11263 + DUP
    8 +
    DO
      i C! -1
    +LOOP ;
```

This word takes nine numbers from the stack; the first eight define the character and the ninth is the ASCII value of the character. It makes a loop, using as its limits the sections of memory at the beginning and end of the space we want to fill. It then puts each of the numbers into its appropriate place. It is taken from the Ace manual.

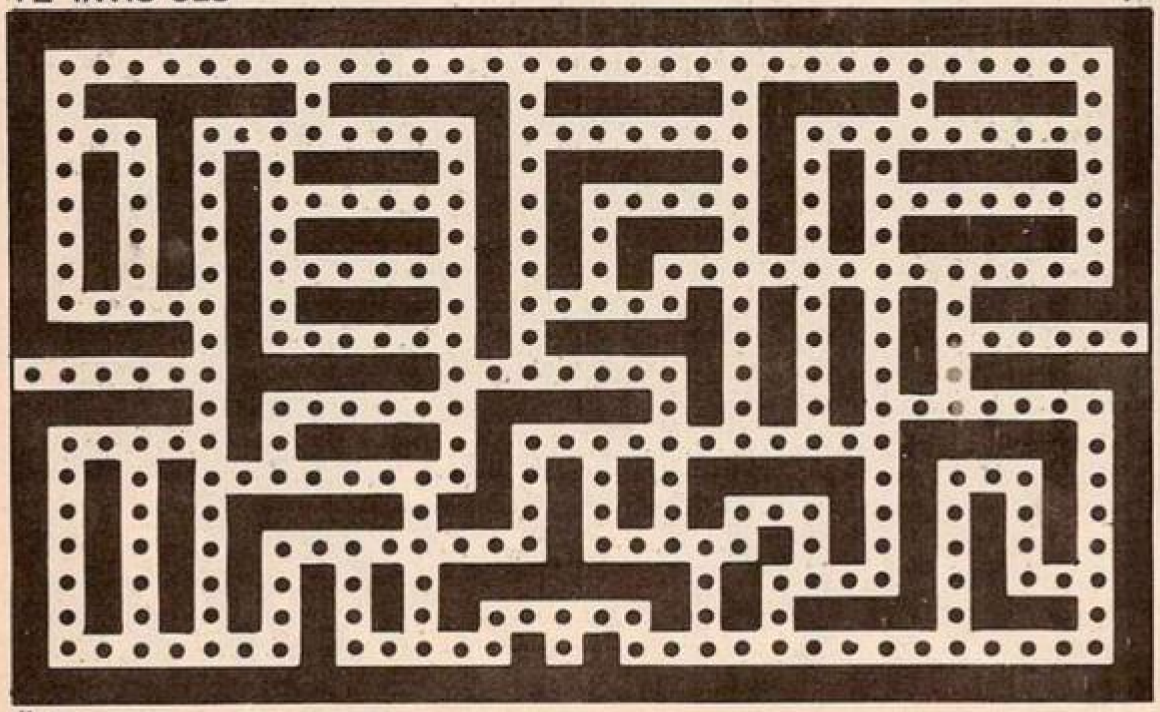
```
: A 85 170 85 170 85 170 85 170 1 GR        Wall
    0  0  0 24 24  0  0  0 2 GR             Dot
   28 20  8 127 8 20 34 65 3 GR             Man
   NM 5 GR
   NM 35 GR ;
```

When you have typed this in, A will run the routine and store the characters appropriately. This section should then be saved on tape by starting the tape player then entering

SAVE GRAPHICS

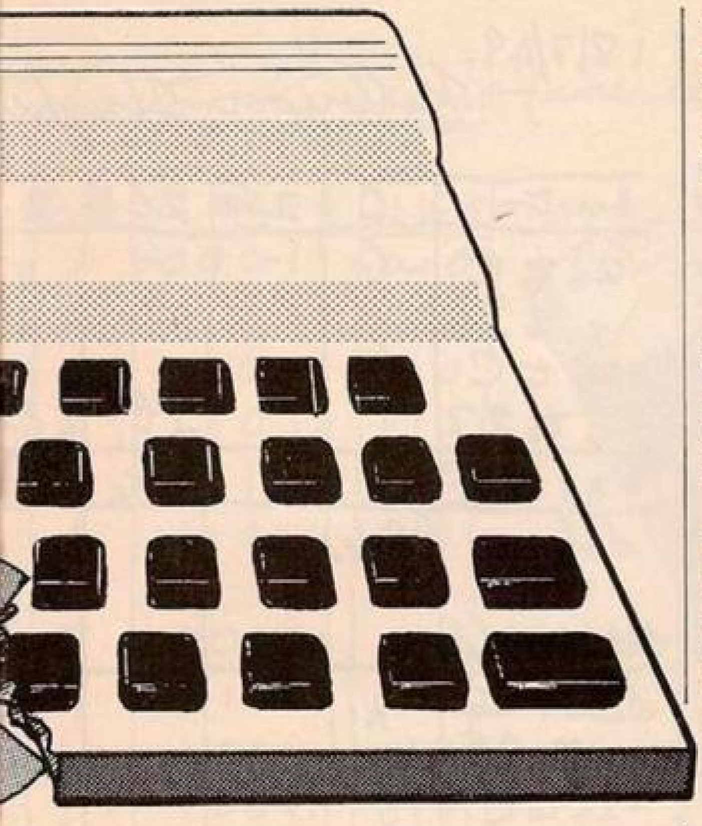
The maze display: snappers and gulpers thrive in this sort of environment.

```
: Z INVIS CLS                                              ."
```



```
" ;
```

FOR GAMES



You can then verify it as explained in the manual and delete it from memory using

```
FORGET NM
```

to leave space for the next section, the game itself.

For this section first enter the variables;

```
0 variable A   The score.
0 variable X   The man's position.
0 variable W   Used for the position of the
               ghost being moved. Y and Z
               are moved to W as needed.
0 variable Y   The positions of the two
0 variable Z   ghosts.
```

Only two ghosts have been used — a third would fit in the memory but with the speed at which the program runs would make it almost impossible to win.

```
0 variable SD This holds the random number.
0 variable K This sets the difficulty level.
```

The subroutines used by the main words need to go in next so that the compiler recognises them when called from the upper words.

```
: B This fills the screen with dots wherever
    there is no wall and is used whenever the
    dots are all eaten.
    9856 9216
    DO Sets a loop to go over the whole
    screen.
    i c@ 1 = 0 = Checks that the space does
    not contain a wall.
    IF
      2 i c! Puts a dot there if it does not.
    THEN
LOOP
5 Y @ c! 5 Z @ c! Puts the ghosts back on
                  the screen.
Y @ Z @ = IF 8 Y @ c! THEN
```

When a ghost leaves a position then 3 is subtracted from the ASCII value of the character so that it is left as it was; dots use 2 and spaces 32 so the ghost is given values 5 and 35, and 3 is added to the ASCII when the ghost is moved there. Here if the two ghosts are in the same place when all the dots are eaten then 2 + 3 + 3 has to go in that space giving a dot when they both leave.

```
K @ DUP 2 > IF 1- THEN K ! Increases the
difficulty level if it is not at maximum;
: RND This is taken from the Ace manual and
      covered there.
      SD @ 75 u* 75 0 D+
      OVER OVER u< - - 1-
      DUP SD!
          u* SWAP DROP ;
: CPS
```

This is used to add 3 to the position that the ghost moves into and add 253 when it leaves. Adding 253 achieves the same as taking away 3 as one is using a single byte.

```
      SWAP OVER c@ + SWAP c! ;
```

Next the main routines are typed in. M is the routine for moving the man complete with associated checks and score changing. The comments could be typed into the machine but would take up valuable memory and so should be omitted.

```
: M
  INKEY DUP DUP
  52 >SWAP 57 <AND
  This checks that the key is one of the cursor
  control keys 5 to 8; these have ASCII values 53
  through 56.
IF
  52 - DUP Puts the number into the range 1
     to 4
  4 MOD 1 > 31 * 1+ MOD gives the
    remainder after dividing by the preceding
    number so cursor keys 6 and 7 will leave
    32 on the stack while keys 5 and 8 leave 1
    on the stack.
  SWAP 3 < -2 * 1+ * This multiplies the 32
                     or 1 obtained by -1 if
                     keys 5 or 6 were
                     pressed.
  X @ + DUP c@ DUP Leaves on the stack
    the new value of X and two copies of
    what X currently contains.
  1 = 0 =
  IF Continue only if one will not collide with a
    wall.
    32 X @ c! Put a space in the old position
              of the man.
    2 =
    IF Check if the man is eating a dot.
      A @ 1+ DUP DUP A ! 21 0 AT .
      326 MOD 0= IF B THEN Add 1 to the
      score; print the score; check whether all
      the dots have been eaten and refill
      screen if more left.
    THEN
    3 OVER c! X ! Put the man in the new
                  position and store the value
                  of X.
  99 40 BEEP
  ELSE
    DROP DROP Removes unused numbers
              from stack.
  THEN
  ELSE
    DROP
  THEN ;
```

The routines G and H are used together. H is used twice by G to actually move the ghost. H should be typed in before G.

```
: G W @ DUP X @ 16 - <32 * Compares
  the values of X and W to see whether or
  not the ghost should move down. It puts
  32 on the stack if it should.
  SWAP X @ 16 + > - 32 * + H puts - 32
      on the stack if the ghost should move
      up, and then uses H to move it appro-
      priately.
   W @ 32 MOD X @32 MOD > - 2 * 1+H
   Puts 1 or -1 on the stack after comparing
   the horizontal positions of X and W to
   move ghost left or right.
: H W @ + DUP c@ Finds the new position
                 of the ghost.
  1 = 0 = Makes sure that it is not in a wall.
  K @ RND 0= AND Uses the difficulty
                 variable K and RND to
                 limit the probability of
                 the ghost's movement.
  IF
    253 W @ CPS Puts a space or dot where
                the ghost was.
    3 OVER CPS Puts the ghost on the
               screen.
    W ! Stores the new position of the ghost
  ELSE
    DROP
  THEN ;
```

The routines are now linked together by the program word which is Run.

```
: RUN FAST
  9249 X ! 9339 Y ! 9479 Z ! Sets initial
              positions of man and ghosts.
  0 A ! Zeros score. 6 K ! Sets initial difficulty.
  B                      Fills the screen with dots.
  3 9249 c!    Puts the man on the screen. B
  ;B                         puts on the ghosts.
  BEGIN                   The main control loop.
    M                                  Move man.
    Z@W!GW@Z!     Moves the ghost Z by
      putting its value into W which is used by H.
    Y@W!GW@Y!     Does the same for Y.
    X @ DUP Y @ = SWAP Z @ = OR
  UNTIL Compares X to Z and Y. If either
        equal X then the procedure ends
        otherwise it goes back to Begin.
  SLOW
  999 999 BEEP ;
```

The game is stored entering

```
SAVE RUN
```

The screen is created and, then saved as a series of bytes. Enter

```
: Z INVIS CLS."
```

leaving enough space between the CLS and ." so that there is only one space left at the end of the line. Use Shift 9 to put the Ace in graphics mode then, using A for the wall and B for the dots, type in the 20 lines of screen per the attached diagram. On the next line type " ;

Entering Z will now give you the screen in the correct position and it can be saved on to tape by entering

```
8192 768 BSAVE screen
```

Start the tape and press enter.

Clear the memory with

```
FORGET Z
```

The program is now loaded with

```
LOAD GRAPHICS
A
FORGET NM
```

Enter these three together and then start the tape. Stop the tape when you see the cursor.

```
INVIS LOAD RUN 0 0 BLOAD SCREEN
```

Enter this and then restart the tape. Stop it when the screen is full. You can now play the game by entering Run.

If you have queries about the program I can answer them. Write to me with stamped, addressed envelope at 23 Grimston Avenue, Folkestone, Kent. ■

INCREDIBLE S

IF YOU ARE buying an Oric 1 computer, you are acquiring a piece of microelectronic equipment that is the state of the art in home computers. Inside the Oric case is a 6502A central processor unit, CPU; two 2764 read-only memory — ROM — chips;a 6522 versatile interface adaptor, VIA; and eight 4164 dynamic random access memory — RAM — chips as well as a number of other integrated circuits.

All these circuits are mounted on a printed-circuit board and there are inputs and outputs to connect the computer to the outside world. That hardware specification produces a computer that will calculate using one or more high-level languages, control a printer or some other peripheral piece of equipment, interface with a Modem for communicating via British Telecom telephone lines or store and retrieve information from a mass-storage unit called a floppy disc. The Oric computer must contain nearly one million transistors and uses perhaps five watts of power.

You may be forgiven for having a blasé attitude towards "the chip". Although home computers continue to develop at breakneck pace, a number of small machines with a built-in Basic interpreter have been available for three or four years in this country.

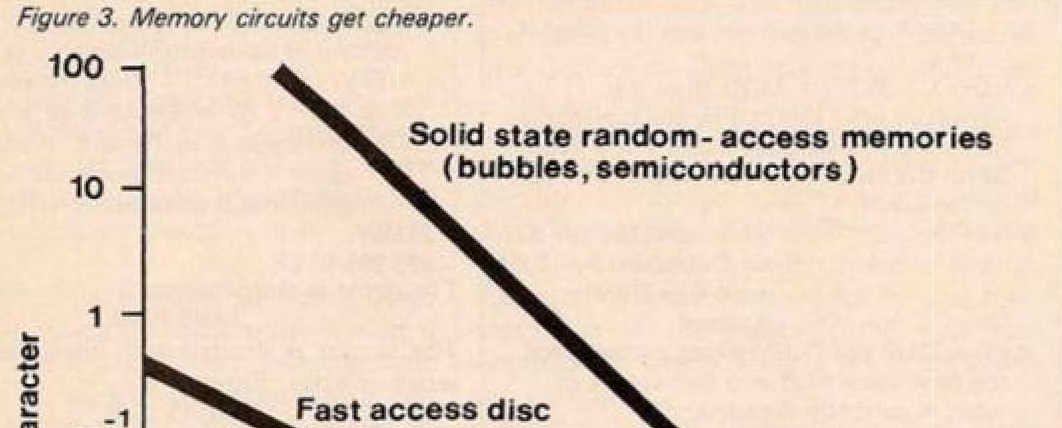
But compare, for a moment, the Oric with the Mark 1 computer built at Manchester University in 1948. Like the Oric the Mark 1 used dynamic memory. Flip-flops, the electronic circuit at the heart of static memory devices, had to be constructed out of EF-50 pentode valves and the quantities that would have been necessary were simply not a practical proposition.

So Professor Williams, the head of the development team, invented a way of storing binary numbers using a 12in. diameter cathode ray tude, CRT, roughly similar to the tube in a portable television. He found that it was possible to detect the presence or absence of a pulse by the charge generated in a plate held against the front of the CRT — where the picture would normally be displayed. The charge decayed in about 0.2 seconds but if it was refreshed within that time, it was possible to store 2,048 bits for a period of several hours.

The memory for a stored-program electronic computer was the most troublesome problem at that time. Other groups worked on the development of memory storage using mercury delay lines in which a vibration, or sound wave, was put into one end of a trough of mercury and recovered some time later at the other end.

This technique was also dynamic because

Figure 3. Memory circuits get cheaper.



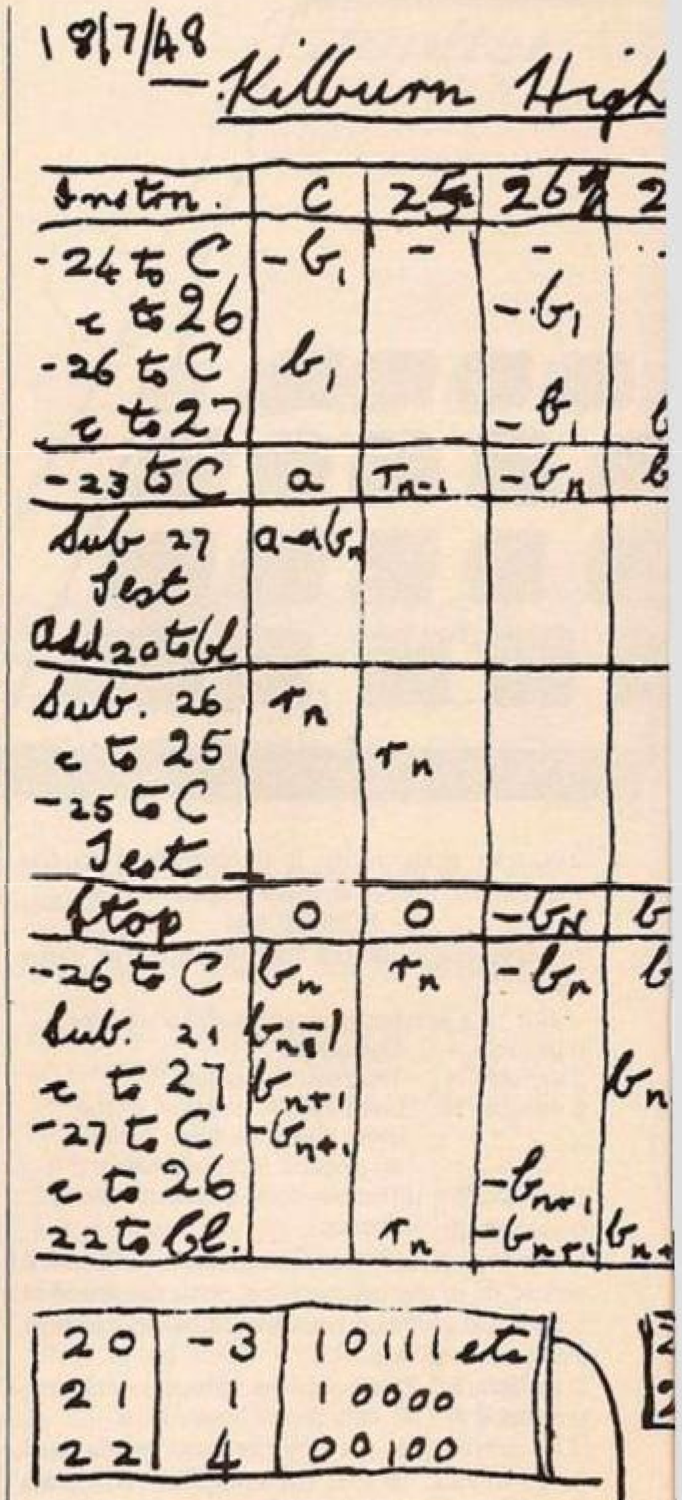
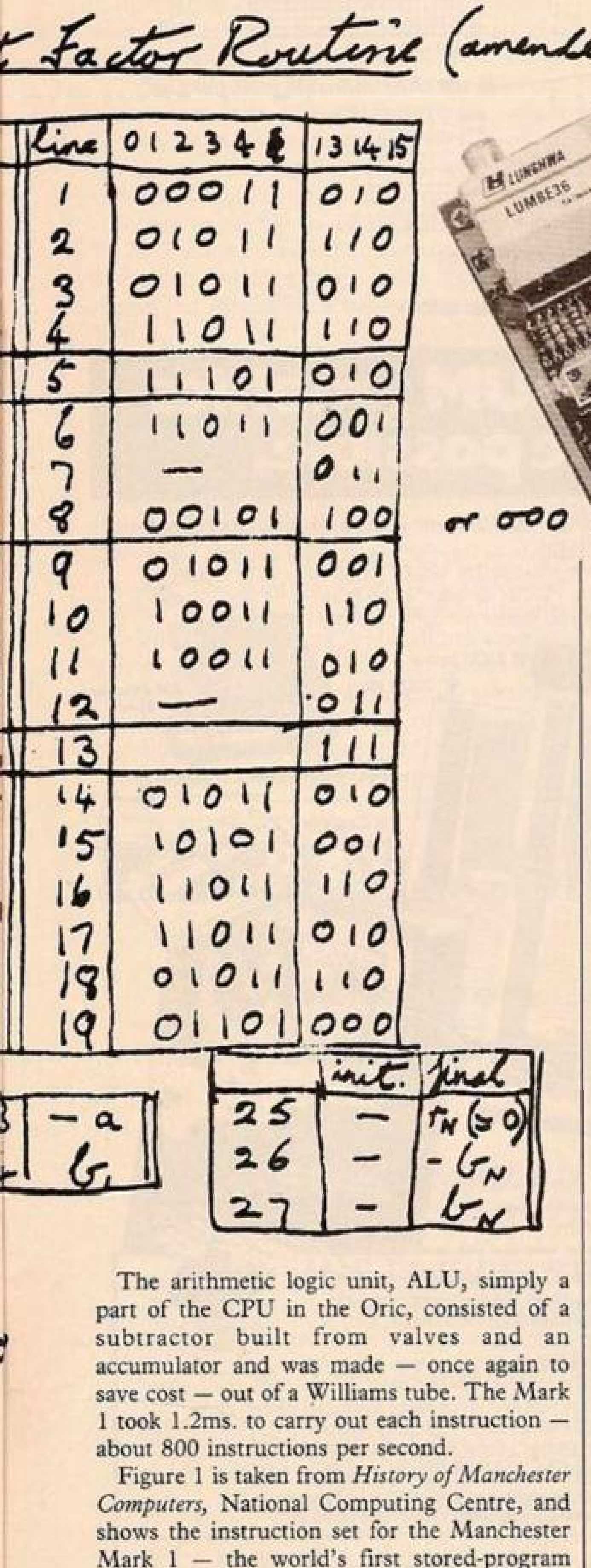


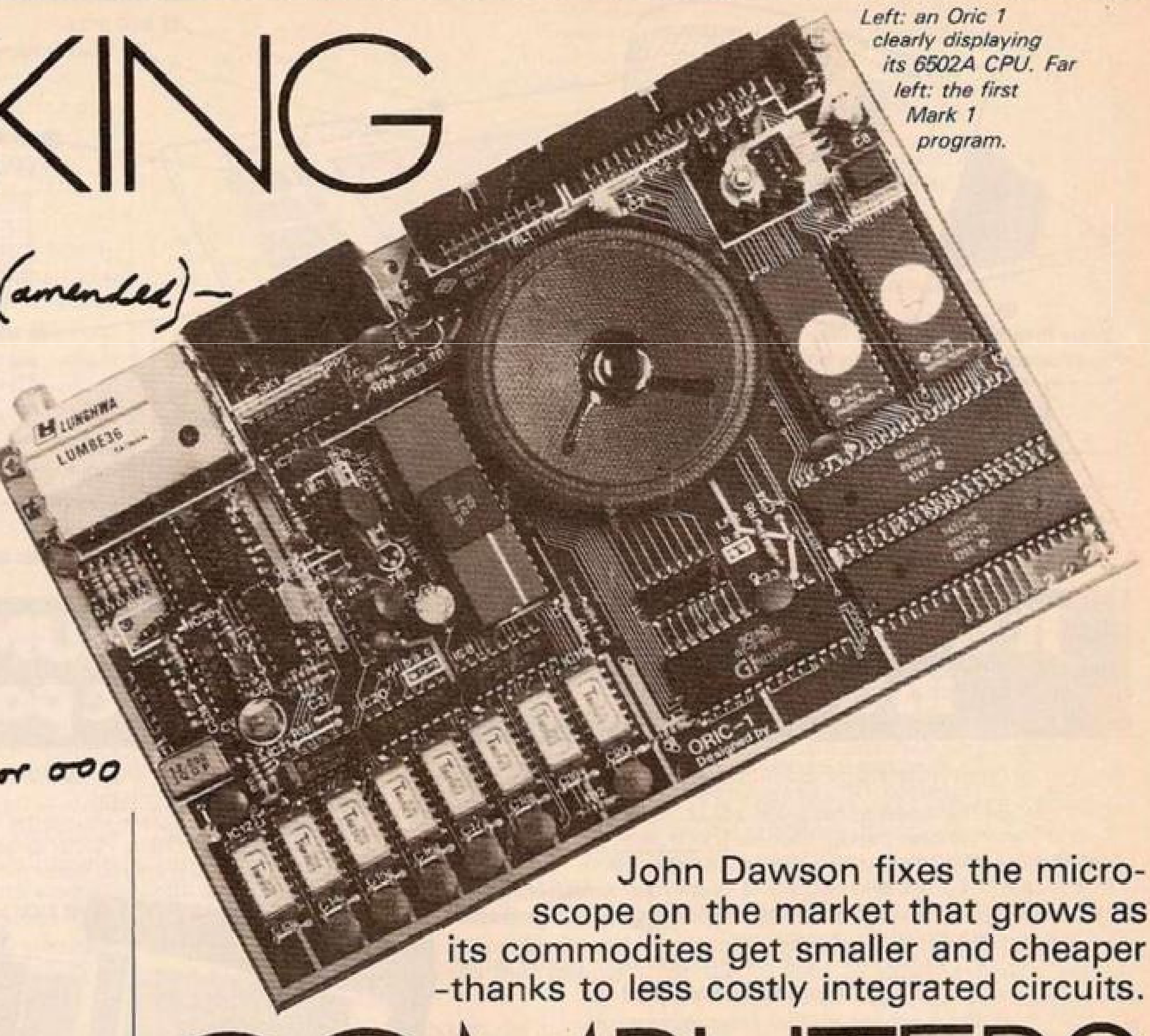
Figure 2. The first computer program.

the impulse had to be recirculated constantly if the information was not to be lost. One advantage of the Williams tube over the mercury delay line was that it allowed random access, while the mercury store was a serial device where one bit chased another down the trough.

The Mark 1 computer had a 32-bit word length compared to the eight-bit bytes that are now standard in the Oric and other home computers. The main store of the machine consisted of a single Williams tube storing 32 words, and — as far as one can make any comparison — that is matched by the 48,000 bytes available in the full Oric.

SHRINKING COMPUTERS





Left: an Oric 1 clearly displaying its 6502A CPU. Far left: the first Mark 1 program.

John Dawson fixes the microscope on the market that grows as its commodites get smaller and cheaper -thanks to less costly integrated circuits.

The arithmetic logic unit, ALU, simply a part of the CPU in the Oric, consisted of a subtractor built from valves and an accumulator and was made — once again to save cost — out of a Williams tube. The Mark 1 took 1.2ms. to carry out each instruction — about 800 instructions per second.

Figure 1 is taken from *History of Manchester Computers,* National Computing Centre, and shows the instruction set for the Manchester Mark 1 — the world's first stored-program electronic computer. Figure 2, from the same publication, shows a revised version of the first computer program, the first program actually ran in June 1948.

Some 18 months later an enlarged version of the Mark 1 was doing useful work for the University and IBM was negotiating for the use of the Williams tube under licence in its 701 series computer.

Magnetic drums were built to increase the quantity of information that could be stored during a program's execution, and Ferranti marketed its Mark 1 computer, based on the Manchester design, with a drum backing store that would hold 3,750 words. The drum store could be extended to hold 15,000 words.

Remember that this was a computer that was sold both in this country and abroad and which provided a "computing power far in excess of the University's own requirements". Hardware was an accurate term for these machines. The weight of the valves and other components meant that rigid metal frames were required to support the circuit boards.

As one small part of the whole machine, a computer of the late sixties using a ferrite core store with a capacity of 4,000 bits would have a frame about the size of a single-bed mattress with driver amplifiers and read circuits to store and recover the state of each core in the small block in the centre of the chassis. Contrast also the 25 kilowatts consumed by the early Manchester computers with the power requirements of the Oric.

Later, in 1959, Manchester started the design and construction of Atlas, which was to be the world's largest computer. The Manchester Atlas was formally brought into service in December 1962. The machine had a 48-bit word, 16K of main store and 8K of read-only store. Interrupt handling, which you now take for granted, was a notable feature of the machine and allowed the connection of up to 512 peripherals. An Atlas computer was used at the SRC laboratory at Chilton until 1974.

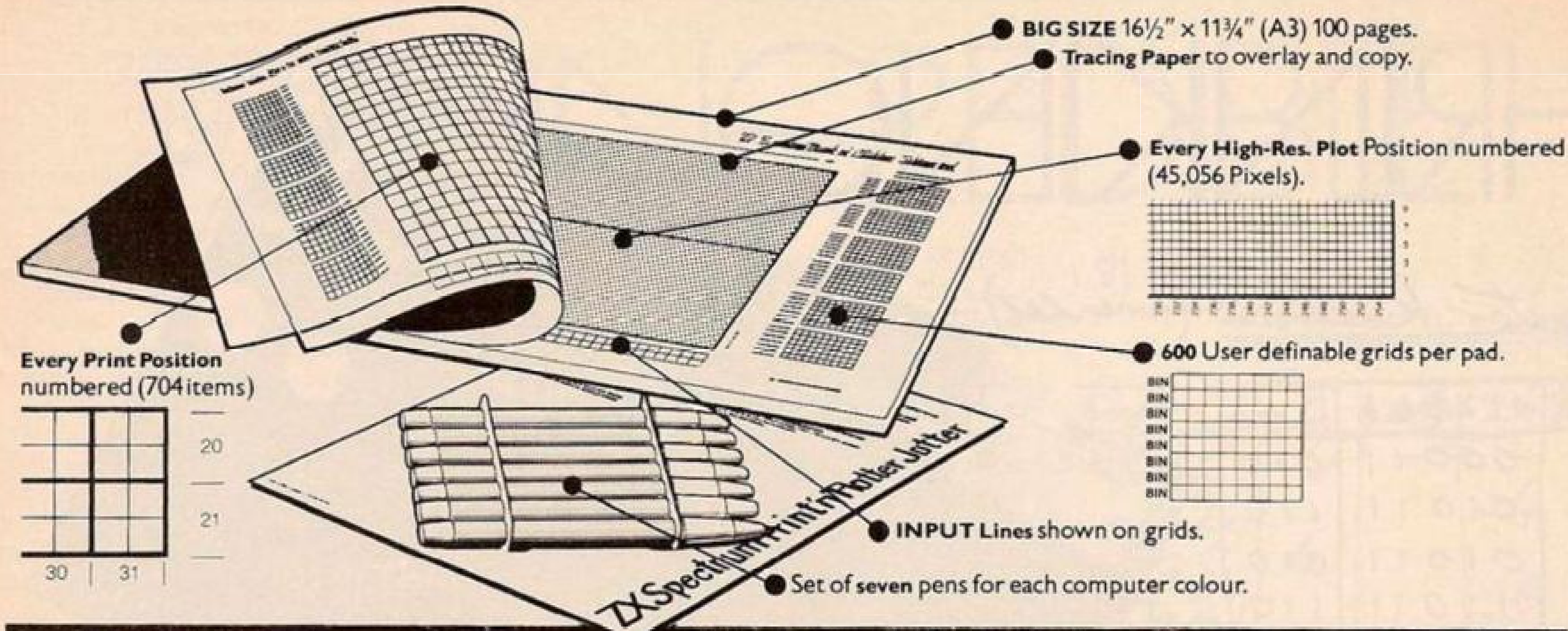
The development of the transistor around 1947 took some time to percolate through into the design and construction of computers. Early point-contact transistors certainly saved power when compared to valves, but had rather unstable operating characteristics. Nevertheless computers were the ideal market for transistors and for the solid-state integrated circuits that followed.

The reason for the success of the transistor in computer circuits is that digital designs require large numbers of active devices in comparison to the analogue designs used for communications equipment and the entertainment market. A six-transistor radio was an advanced piece of equipment in the early sixties and if it had a radio-frequency amplifier employing another transistor, it was definitely upmarket and advertised as such.

On the other had, a central processor unit such as the 8085, marketed by Intel uses about 6,200 transistors and that takes no account of the memory for the computer or the other control circuits.

It would be comforting to think that the development of microelectronics for the

(continued on page 73)



It will improve your ZX SPECTRUM graphics in ways you wouldn't believe possible.

Your new ZX Spectrum is literally packed with sophisticated graphics. Colour. High resolution. Plot. Draw. Circle. Border. Ink. Paper Colours. User-defined characters to name just a few!

That's why we have packed the new Spectrum Print 'n' Plotter Jotter with every facility to exploit your graphics to the full.

After the first few weeks of "playing" with your computer you will want to get down to serious programming and planning in which professional-looking graphics should play a major part.

What better way to work it out than with a Print 'n' Plotter Jotter?

The professional pad

Print 'n' Plotter is not just another programming pad.

Just look at the specifications:

BIG SIZE 16½" x 11¾". 100 Pages — 50 Print Grids and 50 High Resolution Plot Grids.

Printed on high-quality tracing paper, enabling you to overlay the pages for direct co-ordination between PRINT and PLOT or to copy from illustrations, maps, charts, photos etc.

PRINT Grids show all numbered co-ordinates for the 704 screen positions, plus INPUT lines.

PLOT Grids show every numbered co-ordinate for the 45,056 Pixels!

Each pad contains 600 user-definable grids for use with the BIN n, POKE USR "a" function.

And the whole thing is fully bound with fly leaf cover and complete with a set of seven colour pens!

The simple way to get serious

Spectrum Graphics can become very complex, so before you start to program the best way is to work it out on a Print 'n' Plotter and save all those errors!

Take for instance the common CIRCLE. With a Jotter you can establish the exact screen location for the centre in seconds, and it will stop you running out of screen because of a too large radius. Working our DRAW is similar: pre-determine DRAW lines and PLOT positions before you start. With a Jotter you can build-up graphics using every facility with a direct co-ordination between each.

For instance, correct PLOT OVER or PRINT OVER positions will be easy with a Jotter.

See the show for just 95p!

To demonstrate the graphic possibilities with the SPECTRUM JOTTER we have produced a cassette-based Demonstration program for only 95 p (inc VAT and P&P). Why not send for a copy, or order it together with your JOTTER?

Just part of a range of ZX products

The Spectrum Jotter is, of course, an upgraded version of our popular *ZX81 Print 'n' Plotter Jotter and Film*. For ZX81 owners these are available by direct mail or through a growing number of retailers and compshops.

The ZX81 Jotter is a 100 page Graphics pad that exploits to the full the graphics facilities of that micro. ZX81 Film is a matt film version of the Jotter which is re-usable and ideal for 'copying' graphics.

Our manual: *"ZX Graphics programming made easy"* explains everything you need to know about using the ZX81 products, and when used in conjunction with the Spectrum cassette will prove to be the definitive guide to the subject.

And for ZX users (whether Spectrum or ZX81) we still market Printer Paper at £1 less than Sinclairs!

Why not write and place your order today? Graphics can be a very serious subject . . . Print 'n' Plotter products can make it easier . . . and better in a hundred ways you never thought possible!



An illustrated leaflet is sent with all orders. If you require a copy before ordering write enclosing a first class stamp.

To: Print 'n' Plotter Products (YB) 19 Borough High Street, London SE1 Please forward me the following products:

6th ZX MICROFAIR

. . . . . ZX SPECTRUM JOTTERS @ £9.95 each.
. . . . . ZX81 JOTTERS @ £3.50 each.
. . . . . ZX81 PLOTTER FILMS @ £2.25 each.
. . . . . "GRAPHICS PROGRAMMING MADE EASY" MANUALS @ £1.50 ea
. . . . . PACKS OF ZX PRINTER PAPER (5 ROLLS) @ £10.95 per pack.
. . . . . ZX SPECTRUM DEMO CASSETTES @ 95 p each.

PLEASE NOTE ALL PRICES INCLUDE POST, PACKING AND VAT FOR U.K. DELIVERIES (Overseas should add 25% for additional Surface Mail)

Remittance enclosed payable to Print'n'Plotter Products.
Please bill my Access/Barclaycard/Visa/Mastercard No:–

Name: . . . .

Address: . . . .

Print'n'Plotter Products©

Most Print 'n' Plotter products are available "over the counter" from the following retailers. Branches of W. H. Smith ● Buffer Micro Shop, Streatham, London ● Denny's Booksellers, London EC1 ● Georges Bookshop, Bristol ● Telford Electronics & Computing, Hollinswood, Telford ● Personal Computer Services, Darwen, Lancs

(continued from page 71)

computer market came about because of the opportunities for enhancing the lives of individuals or even for commercial reasons. Not so — microelectronics was spawned by missile and satellite programs and promoted by military and space agencies in the United States.

Integrated circuits became possible only after someone conceived that transistors, resistors, diodes, and so on, could be separated by insulation on the same piece of silicon rather than the physical separation which previously had been the rule. In 1964, Gordon Moore, the director of research at Fairchild, predicted that integrated circuits would continue to double in complexity every year. In 1977 some circuits that were commercially available contained more than 260,000 elements and Moore's law has continued to hold true.

The cost of integrated circuits has declined consistently. Figure 3 illustrates the downward trend for memory circuits. Changes in technology have helped to keep the trend running according to Moore's prediction. X-ray lithography is a form of contact lithography which allows the production of integrated circuits with finer "wires" — strips of metal that connect one circuit element to another — than was possible with ultraviolet or visible light lithography. Gallium arsenide offers much higher switching speeds than silicon and the Josephson Junction, operating at temperatures close to absolute zero, may be the fundamental component of the future.

We may have swapped the expensive, heavy, power-consuming, air conditioning of the past for a similar refrigeration plant in the future to allow a few cubic inches of silicon to run at BIPS speeds. BIPS? — billions of instructions per second, of course. A few cubic inches? Well, the speed of light starts to slow a computer down when different parts of the machine are some distance apart. Josephson Junction machines will operate most efficiently if the computer can be kept within a total dimension of a few inches in any direction so that electrical impulses do not have to travel even a few metres from one part of the micro to another.

How does all of this reflect on the little Oric — the state-of-the-art machine? The Oric uses essentially the same architecture as the first Manchester machine. John von Neumann set out the principle of a computer in which the instructions are combined with the data, the Harvard architecture separated the two.

The beginners' all-purpose symbolic instruction code — Basic — high-level language supplied with the Oric is beyond the dreams of the first pioneers in the North of England. After all, it was those connected with the earliest computers who thought, as they gazed at the machine in almost religious awe, that four computers would be sufficient for the world's computing needs. ■

Decimal value of function bits	An early notation	Modern mnemonic	Explanation of operation
0	s, C	JMP S	Absolute indirect unconditional jump: set the control register equal to the contents of address S.
1	c+s, C	JRP S	Relative indirect unconditional jump: add the contents of address S to the control register.
2	-s, A	LDN S	Load negative: set the accumulator equal to the negated contents of address S.
3	a, S	STO S	Store: copy the contents of the accumulator to address S.
4 or 5	a-s, A	SUB S	Subtract: set the new value of the accumulator equal to the former contents minus the contents of address S.
6	Test	CMP	Compare against zero: the value in the accumulator is tested. If it is less than zero, one is added to the control register thus causing the next sequential instruction to be skipped.
7	Stop	STP	Stop: cease automatic mode, and await manual commands from the operator's keyboard.

Figure 1. The Manchester Mark 1 instruction set.

Trevor Hill sets out a more comprehensive and user-friendly machine-code monitor for the Sinclair ZX-81.

ZX-81 EDITOR

MANY machine-code routines suffer, in my opinion, from some deficiency, typically not disassembling all Z-80 instructions; not dealing correctly with RST 08 and RST 28 instructions; not easily allowing the loading of other programs while the routines are in memory; not providing facilities for expansion; not being particularly user-friendly.

These routines have been written in an attempt to overcome these difficulties. The first three routines and operating system occupy just under 2K of memory and present a formidable task to input and get working in one go. I would therefore suggest that the program is broken down into several stages.

The machine-code utility program is intended to provide routines that are particularly user-friendly. The routines are tucked away in memory so that their presence is not noticed until they are actually required.

Figure 1 details the Basic program which is loaded into the computer in the normal manner. Once loaded the program runs automatically placing the machine-code routines — initially held in a string in the variables area — at the top end of RAM. A reduced value for RAMtop is then automatically set and the program commits hari-kari by executing New. This brings into operation the revised value of RAMtop so protecting the machine code, and wipes out the loading program, giving what appears to be a completely empty RAM.

Any other program on which you may want to use the routines can then be loaded in the normal way. To access the routines the following lines of Basic are added to the program:

```
9996 STOP
9997 POKE 16417, 0
9998 RAND USER 32598
9999 GOTO 9996
```

The menu is displayed by Run 9999. You will see from figure 2 that the menu has been designed to accommodate up to 16 routines. The program now waits for you to select a particular routine by input of the appropriate hexadecimal digit. The digit is displayed and once checked the routine may be executed by Newline.

This first routine is a disassembler routine which deals correctly with all the Z-80 instructions as used on the ZX-81. In particular it recognises that the instruction RST 08 is required to be followed by one data byte and that RST 28 may be followed by any number of data bytes terminated by 34. When executed you are asked for the start address, finish address and dump details, one to printer — any other hexadecimal digit to screen.

Figure 3 illustrates the format used whenever input is required: a prompt message followed by a question mark.

The routines have been designed to protect the user as far as possible. For example if the routine is requesting an address it will only accept hex digits and these have to be of exactly the right length.

Once you have input the data, the question mark will remain until you confirm it is correct by typing Newline. Should you make a typing error this may be corrected, as in Basic, by using the Rubout key — Shift 0.

In this, and any of the other routines, whenever input is being requested the routine may be terminated by using the Break key.

The bottom section, figure 5, is a typical output from the disassembler. The first column gives the start address of the instructions, the second the instruction code and third the mnemonic.

Since this is a one-pass disassembler, labels are not included, therefore all jump-relative instructions give, as part of the mnemonic, the absolute jump address.

If the output is to the screen then Screen Fill will generate the usual message — report code 5. Display may be continued, as in Basic, by use of Cont.

The features detailed for the previous routine apply to the Print Data routine. The output is now data rather than instructions.

This Write routine enables code or data to be Input. The start address is requested and then code or data may be input. It is intended that each line of input should correspond to one instruction so the maximum number of bytes that will be accepted is 4. The program knows that each byte occupies two hex digits, so it will not allow an odd number of digits to be input.

Figure 4 lists a suitable Hex loader. Run 100 to list code, Run 300 to write code, and Run 500 to execute code.

As it stands the code in the line 1 Rem statement — figure 5 — will wipe out the Loader program so the following modification is necessary during development.

Change byte 40A7 to C9. This is the Ret instruction code and will stop the routine executing New. Now while you are developing the program you will have to manually set the reduced value for RAMtop each time the computer is switched on and before loading the partially completed program. This can be done by direct commands:

```
POKE 16389, 116
NEW.
```

The menu operating system, first three routines and data occupy just under 2K of memory and the string variable has been set to make the top 3K of RAM available. Therefore 1K is spare for further routines, but the program may be easily modified to make more memory available if necessary.

The machine-code listings have been taken directly from the program using the disassembler and therefore should contain no errors but be careful not to confuse 8,B 6,5 and so on.

If you do not relish writing such a large machine-code program then I can supply a tape and full loading instructions for £3. They may be obtained from Trevor Hill, 1 Highcroft Close, Yardley Gobion, Northants.

(for listings, see page 77)

Figure 1.

```
  1 REM  40 CHARACTERS TO BE
           REPLACED BY M/C
 10 DIM M$(3040)
 20 RAND USR 16514
 30 SAVE "ROUTINES"
 40 RAND USR 16531
```

Figure 2.

```
              MENU
              ====
            0 PRINT CODE
            1 PRINT DATA
            2 WRITE
            3 INSERT
            4 DELETE
            5 TRANSFER
            6 SEARCH
            7 REPLACE
            8 RUN CODE
            9
            A
            B
            C
            D
            E
            F
   ROUTINE  ?
```

Figure 3.

```
           0 PRINT CODE

   START ADDRESS        4082

   FINISH ADDRESS       40A9

   1 FOR PRINTER           ?
```

Figure 4.

```
  90 STOP
 100 PRINT "LIST FROM"
 110 GOSUB 8100
 120 LET A=X
 130 GOSUB 8000
 140 PRINT X$;"  ";
 150 FOR J=1 TO 4
 160 LET X=PEEK A
 170 GOSUB 8050
 180 PRINT X$;" ";
 190 LET A=A+1
 200 NEXT J
 210 PRINT
 220 GOTO 130
 300 PRINT "WRITE TO"
 310 GOSUB 8100
 320 LET A=X
 330 SCROLL
 340 LET X=A
 350 GOSUB 8000
 360 PRINT X$;"  ";
 370 INPUT A$
 380 IF A$="S" THEN STOP
 390 IF LEN A$<>2*INT (LEN A$/2)
THEN GOTO 370
 400 PRINT A$
 410 LET X$=A$( TO 2)
 420 GOSUB 8120
 430 POKE A,X
 440 LET A=A+1
 450 LET A$=A$(3 TO )
 460 IF A$>"" THEN GOTO 410
 470 GOTO 330
 500 PRINT "RUN FROM"
 510 GOSUB 8100
 520 CLS
 530 RAND USR X
 540 STOP
8000 LET X=INT (A/256)
8010 LET Y=X
8020 GOSUB 8050
8030 LET X=A-Y*256
8040 GOTO 8060
8050 LET X$=""
8060 LET K=INT (X/16)
8070 LET X$=X$+CHR$ (K+28)
8080 LET X$=X$+CHR$ (X-K*16+28)
8090 RETURN
8100 INPUT X$
8110 IF LEN X$<>4 THEN GOTO 8100
8120 LET X=0
8130 FOR I=1 TO LEN X$
8140 LET X=X*16+CODE X$(I)-28
8150 NEXT I
8160 RETURN
```

Figure 5.

```
4082 2A1040   LD   HL,(4010)
4085 110600   LD   DE,0006
4088 19       ADD  HL,DE
4089 EB       EX   DE,HL
408A 210074   LD   HL,7400
408D 01E00B   LD   BC,0BE0
4090 EDB0     LDIR
4092 C9       RET
4093 2A1040   LD   HL,(4010)
4096 110600   LD   DE,0006
4099 19       ADD  HL,DE
409A 110074   LD   DE,7400
409D 01E00B   LD   BC,0BE0
40A0 EDB0     LDIR
40A2 3E74     LD   A,74
40A4 320540   LD   (4005),A
40A7 CDC303   CALL 03C3
```

HOW TO GROW UP TO A REAL COMPUTER



If you're enthusiastic about microcomputing, sooner or later you'll ask yourself the question . . . "where do I go from here?"

How BASICARE build into a complete computing package.



This is particularly true if you own a micro with limited expansion and hardware peripheral options . . . like the ZX81.

Now your question can be answered in three short words:

BASICARE MICRO SYSTEMS

BASICARE are the inventors, developers and manufacturers of a totally unique microcomputing upgrade system.

It's the sort of system others have dreamed about . . . a series of separate modules that perform a whole range of microcomputing functions that simply (and firmly) stack together.

If you're confused . . . don't be . . . you only have to think of it in terms of the way Hi-Fi equipment has evolved.

You buy the hardware you want and add to the system! Each module may have a separate function or integrate functions. And when you want more . . . you add more!

In short you can develop a whole range of hardware options that fit together to form a complete package . . . "Computing" in the real sense of the word!

And what a package!

Apart from it's good looks and stability under working conditions, BASICARE MICRO SYSTEMS offers a fantastic range of micro options for ZX81 users.

Of course, such a system needs a starting point from which to expand. The heart of BASICARE'S system is a unique computer interface which we call PERSONA.

This one unit simply plugs into your ZX81 without modification and acts as the "brains" of the whole operation.

Thereafter you choose how you want to expand your micro by simply plugging-in more modules.

Look at the choice you have:

PERSONA — An interface module to enable an ORGANIC MICRO to grow on the ZX81.
MINIMAP — A memory mapping device to extend the address space of the ZX81 from 64K bytes to 1 M bytes.
RAM 08 — A low cost, low power memory expandable from 2K to 8K.
RAM 16 — 16K Add on memory at remarkably low cost.
RAM 64 — A TRUE 64K Add on memory.
DROM — Ultra low power memory backed by rechargeable battery for non-volatile storage of programs and data.
TOOLKIT — A module fully socketed to take up to 8K bytes of utilities in EPROM/ROM.
PERICON a — A general purpose, user programmable device providing 24 lines of input/output.
PERICON b — 24 lines of heavy duty output to access and control the outside world.
PERICON c — A module to drive 80 column printer with Centronics type parallel interface.
USERFONT option — User definable characters available for RAM 08, DROM and TOOLKIT.

Of course, there's lots more BASICARE Modules under development including joysticks, EPROM Programmer, Floppy Disc Controller and much more.

BASICARE is the sort of system that GROWS when you grow . . . and remember, when you change your micro, you will be able to change to a PERSONA unit to suit your new equipment!

In short, BASICARE will serve you forever . . . no matter how big you want to grow!

"As space is limited to describe BASICARE products, we have produced a fully documented brochure . . . send for it today (enclosing stamp please).



BASICARE MICRO SYSTEMS are available by mail simply by sending today together with cheque/ P.O./Access or Barclaycard No. Please indicate clearly your exact requirements.

Name: ______________________

Address: ______________________

____

PERSONA	@ **£30.25**	DROM(2K)	@ **£39.50**
MINIMAP	@ **£35.95**	TOOLKIT	@ **£22.20**
RAM8 (2K)	@ **£24.50**	PERICON A	@ **£27.90**
RAM16	@ **£26.75**	PERICON B	@ **£33.75**
RAM64	@ **£76.25**	PERICON C	@ **£41.75**

Options: USERFONT @ £8.00,
Add 2K for RAM8 @ **£6.50,** Add 2K for DROM @ **£7.50**

All prices include VAT, postage and packing in the U.K. (Overseas allow at least 15% for surface mail).

Post today to: BASICARE MICROSYSTEMS LTD., Dept Y 5 Dryden Court, London SE11 4NH or Phone: 01-735 6408

BASICARE MICRO SYSTEM

(continued from page 75)

Machine-code listing.

```
7C00 A7A8A9AA DEFB
7C04 ADB1C0A6 DEFB
7C08 A6C1A610 DEFB
7C0C 43911045 DEFB
7C10 91E7E7C3 DEFB
7C14 C5C1C262 DEFB
7C18 A845A847 DEFB
7C1C D649D647 DEFB
7C20 A649A629 DEFB
7C24 26A62835 DEFB
7C28 B13828A8 DEFB
7C2C 2828A89C DEFB
7C30 9D9E9FA0 DEFB
7C34 A1A2A335 DEFB
7C38 3A38AD56 DEFB
7C3C 31B1372A DEFB
7C40 B94B8D2F DEFB
7C44 B5CD58A9 DEFB
7C48 58A8333A DEFB
7C4C A738C326 DEFB
7C50 33A93D34 DEFB
7C54 B734B728 DEFB
7C58 B53534B5 DEFB
7C5C 3738B92F DEFB
7C60 B580D3E2 DEFB
7C64 CBCB29AE DEFB
7C68 2AAEE5E8 DEFB
7C6C 661AA64F DEFB
7C70 E6105C11 DEFB
7C74 DA45DA80 DEFB
7C78 80104191 DEFB
7C7C 5CDACFCF DEFB
7C80 80CF8080 DEFB
7C84 8080338F DEFB
7C88 BF33A8A8 DEFB
7C8C 358435AA DEFB
7C90 B5B247A8 DEFB
7C94 49A8C7C9 DEFB
7C98 3831A638 DEFB
7C9C 37A6E438 DEFB
7CA0 C7272EB9 DEFB
7CA4 372A8938 DEFB
7CA8 2AB91028 DEFB
7CAC 91332AAC DEFB
7CB0 B3AE38C3 DEFB
7CB4 58A82EB2 DEFB
7CB8 9CA49D9E DEFB
7CBC CDCDCDCD DEFB
7CC0 49A947A9 DEFB
7CC4 2E9A379A DEFB
7CC8 CFCF8080 DEFB
7CCC 5E1ADEE9 DEFB
7CD0 E9E0E0E0 DEFB
7CD4 E0A6A6AE DEFB
7CD8 B78080AE DEFB
7CDC A92EB729 DEFB
7CE0 B7CD2885 DEFB
7CE4 E2D334B9 DEFB
7CE8 3334B5CB DEFB
7CEC 292F33BF DEFB
7CF0 D1D1D1D1 DEFB
7CF4 D12D2631 DEFB
7CF8 B9452BA7 DEFB
7CFC 101DA927 DEFB
7D00 9FA6C9B3 DEFB
7D04 AEBB9D66 DEFB
7D08 C62D612E DEFB
7D0C 6D2EBE10 DEFB
7D10 41911041 DEFB
7D14 152A2791 DEFB
7D18 CDD3D9DF DEFB
7D1C 3CE5EBEE DEFB
7D20 F3F3F3F6 DEFB
7D24 9181896D DEFB
7D28 6AF9763A DEFB
7D2C 709CA176 DEFB
7D30 A4AAADFC DEFB
7D34 B39666B8 DEFB
7D38 C1C7871B DEFB
7D3C 81A1E47F DEFB
7D40 0F095C27 DEFB
7D44 A829AA37 DEFB
7D48 B137B72A DEFB
7D4C 6D31A926 DEFB
7D50 9A2F6734 DEFB
```

```
7823 CDFD78   CALL 78FD
7826 CD0979   CALL 7909
7829 1805     JR   7830
782B 1613     LD   D,13
782D CD537B   CALL 7B53
7830 CD817B   CALL 7B81
7833 3005     JR   NC,783A
7835 AF       XOR  A
7836 322140   LD   (4021),A
7839 C9       RET
783A 217840   LD   HL,4078
783D 3630     LD   (HL),30
783F 23       INC  HL
7840 3678     LD   (HL),78
7842 CD8E7A   CALL 7A8E
7845 CD727A   CALL 7A72
7848 78       LD   A,B
7849 FE76     CP   76
784B 2008     JR   NZ,7855
784D 21F57C   LD   HL,7CF5
7850 CDA47B   CALL 7BA4
7853 18D6     JR   782B
7855 FECB     CP   CB
7857 2832     JR   Z,788B
7859 FEED     CP   ED
785B 2838     JR   Z,7895
785D FEDD     CP   DD
785F 2844     JR   Z,78A5
7861 FEFD     CP   FD
7863 2844     JR   Z,78A9
7865 CD4F7A   CALL 7A4F
7868 2E24     LD   L,24
786A FE00     CP   00
786C 2811     JR   Z,787F
786E 2E2C     LD   L,2C
7870 FE01     CP   01
7872 280E     JR   Z,7882
7874 2C       INC  L
7875 FE02     CP   02
7877 2809     JR   Z,7882
7879 3E5E     LD   A,5E
787B 32427D   LD   (7D42),A
787E 2C       INC  L
787F 7D       LD   A,L
7880 81       ADD  A,C
7881 6F       LD   L,A
7882 267D     LD   H,7D
7884 6E       LD   L,(HL)
7885 EB       EX   DE,HL
7886 CDD47A   CALL 7AD4
7889 18A0     JR   782B
788B CD727A   CALL 7A72
788E CD4F7A   CALL 7A4F
7891 C636     ADD  A,36
7893 18EC     JR   7881
7895 CD727A   CALL 7A72
7898 CD4F7A   CALL 7A4F
789B 2E18     LD   L,18
789D FE01     CP   01
789F 28DE     JR   Z,787F
78A1 2E20     LD   L,20
78A3 18DA     JR   787F
78A5 3E0B     LD   A,0B
78A7 1802     JR   78AB
78A9 3E0D     LD   A,0D
78AB 32417D   LD   (7D41),A
78AE 3E12     LD   A,12
78B0 32407D   LD   (7D40),A
78B3 2AF87F   LD   HL,(7FF8)
78B6 23       INC  HL
78B7 7E       LD   A,(HL)
78B8 21167D   LD   HL,7D16
78BB CD897A   CALL 7A89
78BE 23       INC  HL
78BF CBBE     RES  7,(HL)
78C1 CD727A   CALL 7A72
78C4 78       LD   A,B
78C5 FECB     CP   CB
78C7 2005     JR   NZ,78CE
78C9 CD727A   CALL 7A72
78CC 180D     JR   78DB
78CE CD4F7A   CALL 7A4F
78D1 FE03     CP   03
78D3 2893     JR   Z,7868
78D5 F5       PUSH AF
78D6 C5       PUSH BC
78D7 FE00     CP   00
78D9 2005     JR   NZ,78E0
78DB 3E06     LD   A,06
78DD B8       CP   B
78DE 2003     JR   NZ,78E3
78E0 CD727A   CALL 7A72
78E3 C1       POP  BC
78E4 F1       POP  AF
78E5 1881     JR   7868
78FD 01937B   LD   BC,7B93
7900 3E02     LD   A,02
7902 11F87F   LD   DE,7FF8
7905 CD147A   CALL 7A14
7908 C9       RET
7909 11E110   LD   DE,10E1
790C CD3B7B   CALL 7B3B
790F 2B       DEC  HL
7910 7E       LD   A,(HL)
7911 212140   LD   HL,4021
7914 3603     LD   (HL),03
7916 FDCB01CE SET  1,(IY+01)
791A FE1D     CP   1D
791C C42A0A   CALL NZ,0A2A
791F C9       RET
7920 CDFD78   CALL 78FD
7923 CD0979   CALL 7909
7926 21F97C   LD   HL,7CF9
7929 CD9F7B   CALL 7B9F
792C 217840   LD   HL,4078
792F 3633     LD   (HL),33
7931 23       INC  HL
7932 3679     LD   (HL),79
7934 CD817B   CALL 7B81
7937 F8       RET  M
7938 CD3D7A   CALL 7A3D
793B 0E04     LD   C,04
793D CD727A   CALL 7A72
7940 0D       DEC  C
7941 200B     JR   NZ,794E
7943 CD817B   CALL 7B81
7946 30F5     JR   NC,793D
7948 1613     LD   D,13
794A CD537B   CALL 7B53
794D C9       RET
794E CD4879   CALL 7948
7951 18E1     JR   7934
7953 3E01     LD   A,01
7955 01937B   LD   BC,7B93
7958 CD0279   CALL 7902
795B CD2A0A   CALL 0A2A
795E CD0E0C   CALL 0C0E
7961 CD3D7A   CALL 7A3D
7964 11E81C   LD   DE,1CE8
7967 CDA57F   CALL 7FA5
796A CB45     BIT  0,L
796C 2805     JR   Z,7973
796E CDAD7F   CALL 7FAD
7971 10F7     JR   796A
7973 ED5BF87F LD   DE,(7FF8)
7977 CDB878   CALL 78B8
797A ED53F87F LD   (7FF8),DE
797E 3E76     LD   A,76
7980 D7       RST  10
7981 18DB     JR   795E
7983 0D       DEC  C
7984 2024     JR   NZ,79AA
7986 0E04     LD   C,04
7988 1613     LD   D,13
798A CD537B   CALL 7B53
798D 1818     JR   79A7
798F 78       LD   A,B
7990 FE01     CP   01
7992 201A     JR   NZ,79AE
7994 217840   LD   HL,4078
7997 3662     LD   (HL),62
7999 23       INC  HL
799A 367A     LD   (HL),7A
799C 1613     LD   D,13
799E CD537B   CALL 7B53
79A1 21F97C   LD   HL,7CF9
79A4 CD9F7B   CALL 7B9F
79A7 CD3D7A   CALL 7A3D
79AA CD727A   CALL 7A72
79AD C9       RET
79AE FE05     CP   05
79B0 C0       RET  NZ
79B1 217840   LD   HL,4078
79B4 3668     LD   (HL),68
79B6 23       INC  HL
79B7 367A     LD   (HL),7A
79B9 0E04     LD   C,04
79BB CD9C79   CALL 799C
79BE 78       LD   A,B
79BF FE34     CP   34
79C1 C8       RET  Z
79C2 CD8379   CALL 7983
79C5 18F7     JR   79BE
79C7 CD727A   CALL 7A72
79CA AF       XOR  A
79CB CB78     BIT  7,B
79CD 2801     JR   Z,79D0
79CF 2F       CPL
79D0 48       LD   C,B
79D1 47       LD   B,A
79D2 2AF87F   LD   HL,(7FF8)
79D5 09       ADD  HL,BC
79D6 EB       EX   DE,HL
79D7 21007D   LD   HL,7D00
79DA 7B       LD   A,E
79DB CD897A   CALL 7A89
79DE 2B       DEC  HL
79DF 7A       LD   A,D
79E0 CD897A   CALL 7A89
79E3 23       INC  HL
79E4 CBBE     RES  7,(HL)
79E6 2B       DEC  HL
79E7 181B     JR   7A04
79E9 CD727A   CALL 7A72
79EC 2B       DEC  HL
79ED 1815     JR   7A04
79EF CD777A   CALL 7A77
79F2 1810     JR   7A04
79F4 CD727A   CALL 7A72
79F7 2B       DEC  HL
79F8 1803     JR   79FD
79FA CD777A   CALL 7A77
79FD 2B       DEC  HL
79FE CDA47B   CALL 7BA4
7A01 210D7C   LD   HL,7C0D
7A04 C3A47B   JP   7BA4
7A07 21007D   LD   HL,7D00
7A0A CD757A   CALL 7A75
7A0D CD727A   CALL 7A72
7A10 CBBE     RES  7,(HL)
7A12 2B       DEC  HL
7A13 C9       RET
7A14 F5       PUSH AF
7A15 D5       PUSH DE
7A16 11E410   LD   DE,10E4
7A19 CD3B7B   CALL 7B3B
7A1C 7D       LD   A,L
7A1D BB       CP   E
7A1E 2805     JR   Z,7A25
7A20 CDAD7F   CALL 7FAD
7A23 18F7     JR   7A1C
7A25 D1       POP  DE
7A26 CD217B   CALL 7B21
7A29 F1       POP  AF
7A2A 3D       DEC  A
7A2B 20E7     JR   NZ,7A14
7A2D C9       RET
7A2E 21427D   LD   HL,7D42
7A31 365C     LD   (HL),5C
7A33 2B       DEC  HL
7A34 3609     LD   (HL),09
7A36 2B       DEC  HL
7A37 360F     LD   (HL),0F
7A39 2B       DEC  HL
7A3A 2B       DEC  HL
7A3B 36E0     LD   (HL),E0
7A3D 11F97F   LD   DE,7FF9
7A40 21FE7C   LD   HL,7CFE
7A43 1A       LD   A,(DE)
7A44 CD7F7A   CALL 7A7F
7A47 1B       DEC  DE
7A48 1A       LD   A,(DE)
7A49 CD7F7A   CALL 7A7F
7A4C AF       XOR  A
7A4D D7       RST  10
7A4E C9       RET
7A4F 78       LD   A,B
7A50 E607     AND  07
7A52 4F       LD   C,A
7A53 78       LD   A,B
7A54 F5       PUSH AF
7A55 E638     AND  38
7A57 0F       RRCA
7A58 0F       RRCA
7A59 0F       RRCA
7A5A 47       LD   B,A
7A5B F1       POP  AF
7A5C E6C0     AND  C0
7A5E 07       RLCA
7A5F CB07     RLC  A
7A61 C9       RET
7A62 CDA179   CALL 79A1
7A65 C32B78   JP   782B
7A68 0E04     LD   C,04
7A6A CDA179   CALL 79A1
7A6D CDBE79   CALL 79BE
7A70 18F3     JR   7A65
7A72 21FE7C   LD   HL,7CFE
7A75 ED5BF87F LD   DE,(7FF8)
7A79 1A       LD   A,(DE)
7A7A 13       INC  DE
7A7B ED53F87F LD   (7FF8),DE
7A7F CD897A   CALL 7A89
7A82 D7       RST  10
7A83 23       INC  HL
7A84 7E       LD   A,(HL)
7A85 CBBF     RES  7,A
7A87 D7       RST  10
7A88 C9       RET
7A89 47       LD   B,A
7A8A E60F     AND  0F
7A8C C61C     ADD  A,1C
7A8E CBFF     SET  7,A
7A90 77       LD   (HL),A
7A91 2B       DEC  HL
7A92 78       LD   A,B
7A93 E6F0     AND  F0
7A95 1F       RRA
7A96 1F       RRA
7A97 1F       RRA
7A98 1F       RRA
7A99 C61C     ADD  A,1C
7A9B 77       LD   (HL),A
7A9C C9       RET
7A9D CB40     BIT  0,B
7A9F 2019     JR   NZ,7ABA
7AA1 CDB37A   CALL 7AB3
7AA4 13       INC  DE
7AA5 C9       RET
7AA6 3E01     LD   A,01
7AA8 CB40     BIT  0,B
7AAA 201E     JR   NZ,7ACA
7AAC 1805     JR   7AB3
7AAE CB40     BIT  0,B
7AB0 200F     JR   NZ,7AC1
7AB2 13       INC  DE
7AB3 AF       XOR  A
7AB4 1814     JR   7ACA
7AB6 CB40     BIT  0,B
7AB8 2807     JR   Z,7AC1
7ABA 13       INC  DE
7ABB 78       LD   A,B
7ABC CB87     RES  0,A
7ABE 0F       RRCA
7ABF 1809     JR   7ACA
7AC1 CDB37A   CALL 7AB3
7AC4 13       INC  DE
7AC5 C9       RET
7AC6 78       LD   A,B
7AC7 1801     JR   7ACA
7AC9 79       LD   A,C
7ACA 13       INC  DE
7ACB 62       LD   H,D
7ACC 6B       LD   L,E
7ACD 6E       LD   L,(HL)
7ACE 267C     LD   H,7C
7AD0 CDA57B   CALL 7BA5
7AD3 C9       RET
7AD4 1A       LD   A,(DE)
7AD5 F5       PUSH AF
7AD6 E607     AND  07
7AD8 21DD7A   LD   HL,7ADD
7ADB 181E     JR   7AFB
7ADD F1       POP  AF
7ADE F5       PUSH AF
7ADF CB77     BIT  6,A
7AE1 280D     JR   Z,7AF0
7AE3 2A3E7D   LD   HL,(7D3E)
7AE6 CB55     BIT  2,L
7AE8 3600     LD   (HL),00
7AEA 23       INC  HL
7AEB 20F9     JR   NZ,7AE6
7AED 223E7D   LD   (7D3E),HL
7AF0 E638     AND  38
7AF2 0F       RRCA
7AF3 0F       RRCA
7AF4 CB0F     RRC  A
7AF6 280C     JR   Z,7B04
7AF8 21047B   LD   HL,7B04
7AFB E5       PUSH HL
7AFC 3C       INC  A
7AFD 267D     LD   H,7D
7AFF 6F       LD   L,A
7B00 6E       LD   L,(HL)
7B01 267A     LD   H,7A
7B03 E9       JP   (HL)
7B04 F1       POP  AF
7B05 CB7F     BIT  7,A
7B07 C0       RET  NZ
7B08 13       INC  DE
7B09 18C9     JR   7AD4
7B0B C5       PUSH BC
7B0C 7D       LD   A,L
7B0D 2EE0     LD   L,E0
7B0F 95       SUB  L
7B10 0F       RRCA
7B11 47       LD   B,A
7B12 7E       LD   A,(HL)
7B13 CD8C7B   CALL 7B8C
7B16 23       INC  HL
7B17 86       ADD  A,(HL)
7B18 D61C     SUB  1C
7B1A 12       LD   (DE),A
7B1B 13       INC  DE
7B1C 23       INC  HL
7B1D 10F3     DJNZ 7B12
7B1F C1       POP  BC
7B20 C9       RET
7B21 C5       PUSH BC
7B22 0602     LD   B,02
7B24 2B       DEC  HL
7B25 4E       LD   C,(HL)
7B26 2B       DEC  HL
7B27 7E       LD   A,(HL)
7B28 CD8C7B   CALL 7B8C
7B2B 81       ADD  A,C
7B2C D61C     SUB  1C
7B2E 12       LD   (DE),A
7B2F 13       INC  DE
7B30 10F2     DJNZ 7B24
7B32 C1       POP  BC
7B33 3E76     LD   A,76
7B35 D7       RST  10
7B36 D7       RST  10
7B37 C9       RET
7B38 11EF10   LD   DE,10EF
7B3B CD337B   CALL 7B33
7B3E 267E     LD   H,7E
7B40 0A       LD   A,(BC)
7B41 6F       LD   L,A
7B42 CD9F7B   CALL 7B9F
7B45 03       INC  BC
7B46 0A       LD   A,(BC)
7B47 6F       LD   L,A
7B48 03       INC  BC
7B49 CDA47B   CALL 7BA4
7B4C CD537B   CALL 7B53
7B4F CDA57F   CALL 7FA5
7B52 C9       RET
7B53 C5       PUSH BC
7B54 D5       PUSH DE
7B55 E5       PUSH HL
7B56 FDCB2146 BIT  0,(IY+21)
7B5A 2808     JR   Z,7B64
7B5C ED4B3940 LD   BC,(4039)
7B60 4A       LD   C,D
7B61 CD0809   CALL 0908
7B64 11E07F   LD   DE,7FE0
7B67 ED4B3E7D LD   BC,(7D3E)
7B6B 0600     LD   B,00
7B6D 79       LD   A,C
7B6E D6E0     SUB  E0
7B70 4F       LD   C,A
7B71 CD6B0B   CALL 0B6B
7B74 FDCB214E BIT  1,(IY+21)
7B78 2803     JR   Z,7B7D
7B7A 3E76     LD   A,76
7B7C D7       RST  10
7B7D E1       POP  HL
7B7E D1       POP  DE
7B7F C1       POP  BC
7B80 C9       RET
7B81 2AFA7F   LD   HL,(7FFA)
7B84 ED5BF87F LD   DE,(7FF8)
7B88 A7       AND  A
7B89 ED52     SBC  HL,DE
7B8B C9       RET
7B8C D61C     SUB  1C
7B8E 07       RLCA
7B8F 07       RLCA
7B90 07       RLCA
7B91 07       RLCA
7B92 C9       RET
7B93 DDE3EBE3 DEFB
7B97 F2F8D5DC DEFB
7B9B 30E300E3 DEFB
7B9F 3EE0     LD   A,E0
7BA1 323E7D   LD   (7D3E),A
7BA4 AF       XOR  A
7BA5 C5       PUSH BC
7BA6 D5       PUSH DE
7BA7 A7       AND  A
7BA8 280B     JR   Z,7BB5
7BAA CB7E     BIT  7,(HL)
7BAC 2003     JR   NZ,7BB1
7BAE 23       INC  HL
7BAF 18F9     JR   7BAA
7BB1 3D       DEC  A
7BB2 23       INC  HL
7BB3 18F2     JR   7BA7
7BB5 CDBB7B   CALL 7BBB
7BB8 D1       POP  DE
7BB9 C1       POP  BC
7BBA C9       RET
7BBB ED5B3E7D LD   DE,(7D3E)
7BBF 7E       LD   A,(HL)
7BC0 CB7F     BIT  7,A
7BC2 2005     JR   NZ,7BC9
7BC4 CDCB7B   CALL 7BCB
7BC7 18F2     JR   7BBB
7BC9 CBBF     RES  7,A
7BCB FE40     CP   40
7BCD 3008     JR   NC,7BD7
7BCF 12       LD   (DE),A
7BD0 13       INC  DE
7BD1 ED533E7D LD   (7D3E),DE
7BD5 23       INC  HL
7BD6 C9       RET
7BD7 23       INC  HL
7BD8 ED533E7D LD   (7D3E),DE
7BDC E5       PUSH HL
7BDD FE43     CP   43
7BDF 3006     JR   NC,7BE7
7BE1 267D     LD   H,7D
7BE3 6F       LD   L,A
7BE4 6E       LD   L,(HL)
7BE5 1814     JR   7BFB
7BE7 FE64     CP   64
7BE9 3005     JR   NC,7BF0
7BEB 267D     LD   H,7D
7BED 6F       LD   L,A
7BEE 180B     JR   7BFB
7BF0 21FE7B   LD   HL,7BFE
7BF3 E5       PUSH HL
7BF4 267D     LD   H,7D
7BF6 6F       LD   L,A
7BF7 6E       LD   L,(HL)
7BF8 2679     LD   H,79
7BFA E9       JP   (HL)
7BFB CDBB7B   CALL 7BBB
7BFE E1       POP  HL
7BFF C9       RET
```

(listing continued on next page)

```
7D54 3AB928A6 DEFB
7D58 26A91AC1 DEFB
7D5C 36B526A6 DEFB
7D60 1AE92E63 DEFB
7D64 E9EFF4FA DEFB
7D68 8FC7FA17 DEFB
7D6C 00E01713 DEFB
7D70 7A45006A DEFB
7D74 C500F559 DEFB
```

(continued on next page)

(continued from previous page)

```
7D78  3E13777A  DEFB
7D7C  450092C5  DEFB
7D80  9E584513  DEFB
7D84  15AAC56A  DEFB
7D88  13724508  DEFB
7D8C  0782C507  DEFB
7D90  0B7FE882  DEFB
7D94  87C8625C  DEFB
7D98  2F908858  DEFB
7D9C  7F467E81  DEFB
7DA0  00FA3E86  DEFB
7DA4  7A438692  DEFB
7DA8  C58AFF5F  DEFB
7DAC  8A7A3B86  DEFB
7DB0  92C58A7F  DEFB
7DB4  467E829E  DEFB
7DB8  CF92007A  DEFB
7DBC  A12F8AC5  DEFB
7DC0  007AA42F  DEFB
7DC4  8AC5007A  DEFB
7DC8  A72F8AC5  DEFB
7DCC  007A6300  DEFB
7DD0  92C5AA52  DEFB
7DD4  62AABAC5  DEFB
7DD8  00508215  DEFB
7DDC  A2C5136A  DEFB
7DE0  4511139A  DEFB
7DE4  C5131100  DEFB
7DE8  8A3E80FA  DEFB
7DEC  86B87FBC  DEFB
7DF0  C487D5B9  DEFB
7DF4  E1D78CE2  DEFB
7DF8  D7FA1900  DEFB
7DFC  D837136A  DEFB
7E00  00000000  DEFB
7E04  322A33BA  DEFB
7E08  00000000  DEFB
7E0C  14141494  DEFB
7E10  1C003537  DEFB
7E14  2E333900  DEFB
7E18  283429AA  DEFB
7E1C  1D003537  DEFB
7E20  2E333900  DEFB
7E24  292639A6  DEFB
7E28  1E003C37  DEFB
7E2C  2E39AA1F  DEFB
7E30  002E3338  DEFB
7E34  2A378920  DEFB
7E38  00292A31  DEFB
7E3C  2A39AA21  DEFB
7E40  00393726  DEFB
7E44  33382B2A  DEFB
7E48  B7220038  DEFB
7E4C  2A263728  DEFB
7E50  AD230037  DEFB
7E54  2A353126  DEFB
7E58  28AA2400  DEFB
7E5C  373A3300  DEFB
7E60  283429AA  DEFB
7E64  25802680  DEFB
7E68  27802880  DEFB
7E6C  29802A80  DEFB
7E70  2B808080  DEFB
7ED0  312E322E  DEFB
7ED4  B937343A  DEFB
7ED8  391D332A  DEFB
7EDC  80383926  DEFB
7EE0  37398026  DEFB
7EE4  2929372A  DEFB
7EE8  38388026  DEFB
7EEC  2E332E38  DEFB
7EF0  2D801D00  DEFB
7EF4  2B343780  DEFB
7EF8  35372E33  DEFB
7EFC  392A3780  DEFB
7F00  23782079  DEFB
7F04  53792378  DEFB
7F08  23782378  DEFB
7F0C  23782378  DEFB
7F10  23782378  DEFB
7F14  23782378  DEFB
7F18  23782378  DEFB
7F1C  23782378  DEFB
```

(listing continued from previous page)

```
7F20  D5        PUSH  DE
7F21  C5        PUSH  BC
7F22  E5        PUSH  HL
7F23  2A2540    LD    HL,(4025)
7F26  E5        PUSH  HL
7F27  ED4B2540  LD    BC,(4025)
7F2B  E1        POP   HL
7F2C  C5        PUSH  BC
7F2D  A7        AND   A
7F2E  ED42      SBC   HL,BC
7F30  28F5      JR    Z,7F27
7F32  79        LD    A,C
7F33  3C        INC   A
7F34  28F1      JR    Z,7F27
7F36  E1        POP   HL
7F37  CDBD07    CALL  07BD
7F3A  7E        LD    A,(HL)
7F3B  E1        POP   HL
7F3C  C1        POP   BC
7F3D  D1        POP   DE
7F3E  FE76      CP    76
7F40  C8        RET   Z
7F41  FE77      CP    77
7F43  C8        RET   Z
7F44  FE0C      CP    0C
7F46  2005      JR    NZ,7F4D
7F48  CD2A0A    CALL  0A2A
7F4B  CF        RST   08
7F4C  0C        DEFB
7F4D  FE1C      CP    1C
7F4F  38CF      JR    C,7F20
7F51  FE2C      CP    2C
7F53  30CB      JR    NC,7F20
7F55  C9        RET
7F56  212140    LD    HL,4021
7F59  CB7E      BIT   7,(HL)
7F5B  2804      JR    Z,7F61
7F5D  2A7B40    LD    HL,(407B)
7F60  E9        JP    (HL)
7F61  21007E    LD    HL,7E00
7F64  0614      LD    B,14
7F66  3E03      LD    A,03
7F68  322140    LD    (4021),A
7F6B  11E118    LD    DE,18E1
7F6E  CD9F7B    CALL  7B9F
7F71  CD537B    CALL  7B53
7F74  10F8      DJNZ  7F6E
7F76  01997B    LD    BC,7B99
7F79  CD3B7B    CALL  7B3B
7F7C  2B        DEC   HL
7F7D  7E        LD    A,(HL)
7F7E  D61C      SUB   1C
7F80  47        LD    B,A
7F81  07        RLCA
7F82  6F        LD    L,A
7F83  267F      LD    H,7F
7F85  7E        LD    A,(HL)
7F86  23        INC   HL
7F87  66        LD    H,(HL)
7F88  6F        LD    L,A
7F89  E5        PUSH  HL
7F8A  C5        PUSH  BC
7F8B  CD2A0A    CALL  0A2A
7F8E  C1        POP   BC
7F8F  3EE0      LD    A,E0
7F91  323E7D    LD    (7D3E),A
7F94  78        LD    A,B
7F95  21107E    LD    HL,7E10
7F98  CDA57B    CALL  7BA5
7F9B  161A      LD    D,1A
7F9D  CD537B    CALL  7B53
7FA0  3E76      LD    A,76
7FA2  D7        RST   10
7FA3  D7        RST   10
7FA4  C9        RET
7FA5  3E01      LD    A,01
7FA7  322140    LD    (4021),A
7FAA  21E07F    LD    HL,7FE0
7FAD  360F      LD    (HL),0F
7FAF  CDC07F    CALL  7FC0
7FB2  CD207F    CALL  7F20
7FB5  FE76      CP    76
7FB7  2010      JR    NZ,7FC9
7FB9  3EE0      LD    A,E0
7FBB  BD        CP    L
7FBC  28F4      JR    Z,7FB2
7FBE  3600      LD    (HL),00
7FC0  23        INC   HL
7FC1  223E7D    LD    (7D3E),HL
7FC4  CD537B    CALL  7B53
7FC7  2B        DEC   HL
7FC8  C9        RET
7FC9  FE77      CP    77
7FCB  2008      JR    NZ,7FD8
7FCD  3EE0      LD    A,E0
7FCF  BD        CP    L
7FD0  28DB      JR    Z,7FAD
7FD2  CDBE7F    CALL  7FBE
7FD5  2B        DEC   HL
7FD6  18D5      JR    7FAD
7FD8  77        LD    (HL),A
7FD9  7B        LD    A,E
7FDA  BD        CP    L
7FDB  28D0      JR    Z,7FAD
7FDD  23        INC   HL
7FDE  18CD      JR    7FAD
```

Table 1. Memory map showing main routines only.

Address	Mnemonic	Comments
07BD	Decode	Finds keyboard character code; ROM.
0A2A	Cls	Clears screen; ROM.
0B6B	Print Str$	Prints mnemonic string: ROM
0C0E	Scroll	Moves display up on line; ROM.
4021	Flag Y	Bit 0-change print position; Bit 1-Print Newline Bit 2-dump to printer; Bit 7-change restart address.
407B	Restart	Contains restart address following full screen and cont command.
7400		Spare
7822		bytes
7823	Routine 0	Disassembler
78E7		Spare
78FC		bytes
78FD	Start/finish addresses	Print request for input and then call input address routine.
7902	A addresses	Print request for the number of addresses specified by register A then call input address.
7909	Check printer	Sets Bit 1 of FLAGS — 4001 — if printer required.
7920	Routine 1	Prints data.
7953	Routine 2	Write.
7983	DEFB	prints data associated with RST 08 and RSt 28 instructions.
79C7	Data	Calculates absolute address for JR instructions and adds number and addresses to mnemonic.
7A14	Input address	Input one address and store in memory.
7A2E	Initial	Sets data at commencement of disassembling each instruction.
7A3D	Next address	Prints next address in Hex.
7A4F	Octal	Converts binary number to octal.
7A62	Cont RST	Called if screen full during decoding of RST 08 or RST 28
7A72	Next byte	prints a byte of instruction.
7A9D	Offsets	Various routines to find mnemonic data. Called from control.
7AD4	Control	Master routine in disassembler.
7B0B	Transfer	Moves data around memory.
7B53	Print string	Main print routine.
7B81	Check finish	Used to determine end of routine.
7B93 7B9E		Data for input prompt messages.
7B9F	Add String	A number of routines to built up mnemonic.
7C00 7CFF		Data for mnemonics.
7D00 7DFF		Data and data pointers for disassembler.
7E00 7EFF		Print data for menu and routines
7F00 7F1F		Addresses of routines
7F20	keyboard	Reads keyboard.
7F56	menu	
7FA5	input string	heart of all input routines.
7FE0 7FEF	mnemonic string	holds instruction mnemonic as it is built up.
7FF0 7FF7		Spare bytes.
7FF8	next	Contains next address for routine.
7FFA	finish	Contains finish address for routine.
7FFC 7FFF		Spare bytes

GET THE BEST NEW PROGRAMS AND THE ALL-TIME GREATS, SPECTRUM OR ZX81

AT SOFTWARE SUPERMARKET NOW

We started Software Supermarket with just one idea. To play all the Spectrum and ZX81 games we could find, to select the very best, and to offer only those to our customers.

Judging by our mail from all over the world, you're very pleased with our free selection service. It's impartial (we produce no programs ourselves) and it saves you £££'s on stamps and mistakes.

And it's fast. We usually despatch your order within 48 hours. Here's the best of the new and the best of them all for your Spectrum. Plus some great ZX81 games. Full detailed catalogue sent free with every order. Or send large SAE for catalogue only.

ZX SPECTRUM: 16/48K

Our latest Top 10 Programs for your Spectrum. They run on both 16 & 48K.

3D TUNNEL Brilliant NEW 3D graphic game by Malcolm "Escape" Evans. Fly down the winding 3D tunnel shooting bats, spiders, frogs and rats! Demo mode: 3 speeds: training program for each phase. And (48K only) watch out for the Tube train! (New Generation) £4.95

3D TANX NEW game with stunning graphics. Shoot the enemy from your 3D tank turret. 3 play levels: accurate ballistics: 1 or 2 players: hold feature: demo mode: training program. And choose your own control keys: even plays 'God Save The Queen'! (DK'Tronics) £4.95

WINGED AVENGER *"One of the best...covers all the stages of the arcade original...a game to come back to." Pop:Comp:Wkly.* Very fast 'PHOENIX'. 7 play levels: 3 attack waves: laser shield: mothership with smart bombs. (Work force) £4.50 (16K ZX81 version, £4.50)

GROUND ATTACK *"Best Spectrum version of the arcade game" Yr:Comp: "Very absorbing" E&C: "Extremely good" Pop:Comp:Wkly.* Thrilling SCRAMBLE'. Pilot your ship thro' 26 zones: up, down, brake, thrust: smart bombs: as you get better, it gets harder. (Silversoft) £5.95

CENTIPEDE The first - and fast - Spectrum version of the famous arcade game. Full arcade movement - left, right, up, down, fire - as you attack the centipede. Great graphics. Watch out for the jumping spider! 3 lives: hold feature. (DK'Tronics) £4.95

ESCAPE *"One of the best and most original games we have seen" S.User.* 5 very real dinosaurs chase you round the maze as you search for the axe to escape. Different maze every time. 5 play levels: 9 speeds: Hall of Fame. (New Generation) £4.95

GULPMAN *"The one cassette that I would buy...an exceptional program." Pop:Comp:Wkly* 15 mazes, each with demo mode: 9 speeds: laser gun helps against 4 chasers. Program your own control keys: personalise/save your very own game. (Campbell) £5.95

COSMOS NEW! Fantastic graphics. Loads in 2 parts (instruction manual first). Protect your 9 ships against 18 aliens, warp mines, asteroids. Your graphic on-board computer helps with elaborate displays. Our favourite new game. (Abbex) £4.95

FAUST'S FOLLY The first adventure we've seen that's worth playing in 16K. It's great and it's got graphics! Loads in two parts: clear instructions first. Then a smashing adventure with directions, inventory, look, score, save. Amazing! Abbex) £4.95

OTHELLO *"Recommended without reserve...a superb opponent" Yr:Comp.* The great 19th Century power game. Surround your opponent: capture his territory. Millions of different games: maximum 60 moves each. 1 or 2 players: demo game: 9 skill levels: print. (Mol) £7.95

ZX81 OWNERS!

Special 16K ZX81 versions of 6 of these programs are available:

WINGED AVENGER	**£4.50**	**PIMANIA**	**£8.00**
OTHELLO	**£6.95**	**CHESS 2**	**£9.95**
BLACK CRYSTAL	**£7.50**	**GREAT BRITAIN LTD**	**£4.95**

Use the coupon to order. Free detailed catalogue of our best ZX81 games with every order. Or send large SAE for catalogue only.

48K SPECTRUM ONLY

These programs use nearly all the Spectrum's 48K. They will not run on the 16K Spectrum. But there are versions of Black Crystal, GB Ltd, Pimania and SpecChess for for 16K ZX81.

PIMANIA *"The best adventure game we have reviewed" S.User. "An adventure enthusiast's dream" C&V Games.* Best use of Spectrum graphics and music we've seen. A wonderfully witty adventure - and you could win the £6,000 Golden Sundial of Pi. (Automata) £10. (ZX81 16K version: £8)

TIMEGATE *"The best graphical game I have seen on any micro" Interface. "Excellent graphics...one of the best" Yr:Comp: "Fast and furious...required playing for any Spectrum owner" Which Micro?* 5 skill levels: training program: Hold: Hall of Fame: keyboard overlay: 26-page on-screen manual: (Quicksilva) £6.95

THE HOBBIT *"Superior to any other adventure game available for the Spectrum" Yr:Comp:* Free 285-page illustrated book of The Hobbit contains clues to help solve the adventure. 30 beautiful full-screen pictures: 500 word vocabulary: 16 page instruction manual: save: print: pause. It took 4 people 18 months to write! (Melbourne House) £14.95

GREAT BRITAIN LTD *"A colourful and sophisticated management game" Pers:Comp:wld: "Difficult and challenging" ZX Comp:* Even plays 'Rule Britannia'! Choose your party and run the country. Will inflation and unemployment come down or the rioters come out? It's up to you. Then watch the results on election night! (Hessell) £5.95 (16K ZX81 version, £4.95)

SPECCHESS *"The standard for ZXChess" ZX Comp: "The strongest chess program" Pop:Comp:Wkly.* Full graphic chessmen: 7 play levels: all legal moves: position analysis for problem-solving: recommended move option: print game history. (Artic) £9.45 (ZX81 non-graphic 16K version £9.95)

BLACK CRYSTAL Take the adventure of your life. 180K of program to unravel, on two double-sided cassettes! You must solve each of the 6 stages to defeat the Lords of Chaos. Real-time monster battles: 16 command keys. (Carnell) £7.50 (16K ZX81 version: Over 100K loads in 7 parts. £7.50)

Post to: SOFTWARE SUPERMARKET, 87 Howard's Lane, London, SW15 6NU.
(If you do not want to cut this magazine, write your order out carefully on plain paper and quote this number: YC7)

I own a 16K Spectrum/48K Spectrum/16K ZX81.

I enclose my Cheque/PO for £............ made payable to Software Supermarket.
Please use block capitals. If we can't read it, you won't get it.

Name ....

Address ....

....

..................Postcode ....

Phone, if any, in case we have any query ....

Program Name	Computer	Price

POSTAGE AND PACKING
U.K. Add 55p only per order
EUROPE. Add 55p for each program
OUTSIDE EUROPE. Add £1 for each program airmail.

P&P £ ....

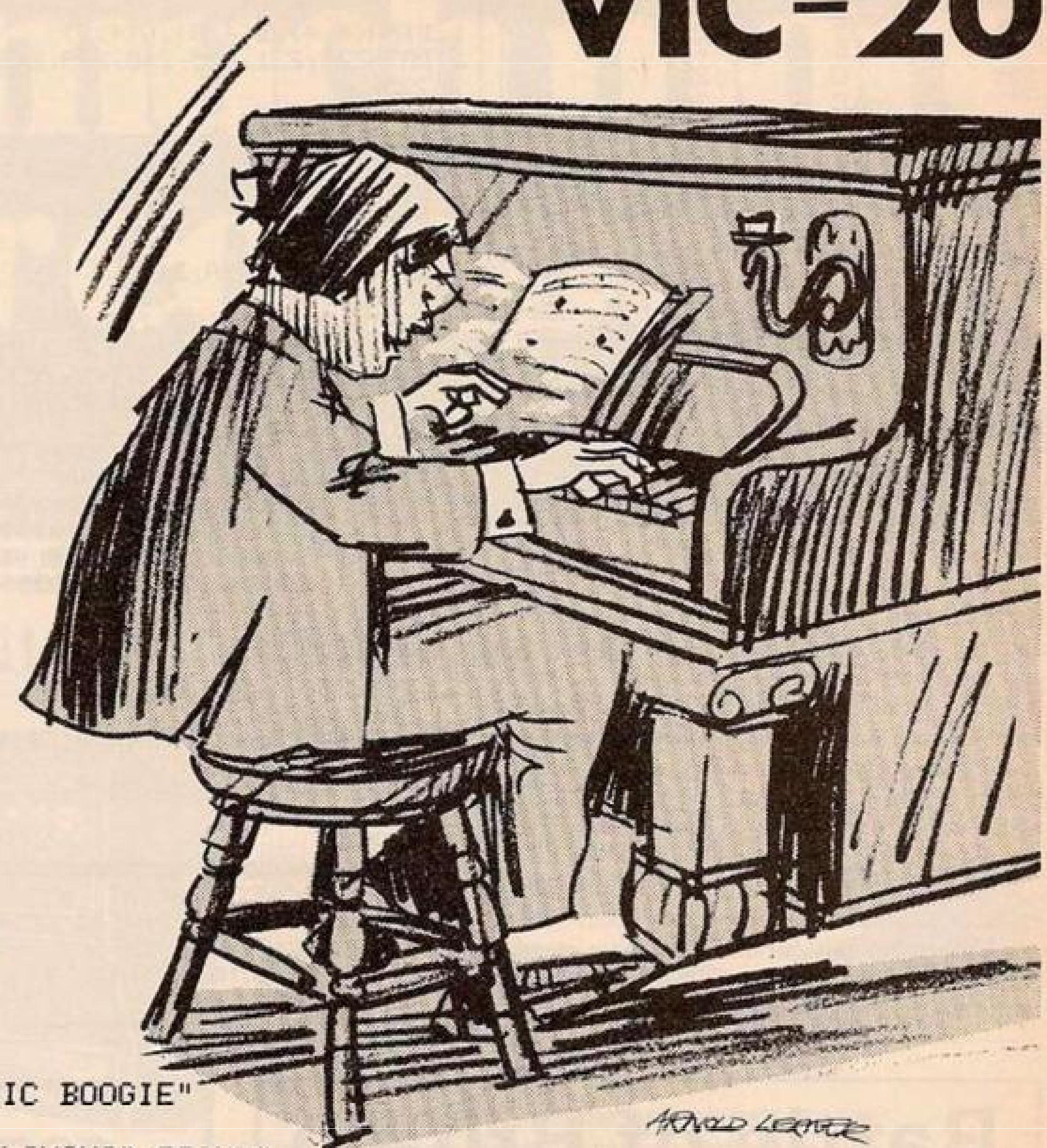
TOTAL £ ....

SOFTWARE SUPERMARKET

87 Howard's Lane, London SW15 6NU. 01-789 8546

The first demonstration program.

```
0 GOSUB40
1 DATA225,231,235,240,
  209,219,225,232,225,231,235,
  240,215,223,228,235:RESTORE
2 FORA=1TO4
3 FORB=1TO4
4 READB(A,B)
5 NEXTB,A
9 POKE36878,15
10 DIMC(4,4),D(4,4)
20 DATA195,215,195,219,195,
   221,195,219
21 DATA209,225,209,228,209,
   229,209,228
22 DATA195,215,195,219,195,
   221,195,219
23 DATA175,201,175,207,175,
   209,175,207
24 REM****************
25 FORA=1TO4
26 FORB=1TO4
27 READC(A,B),D(A,B)
28 NEXTB,A
29 DEL=220
30 FORA=1TO4
31 FORB=1TO2
32 FORC=1TO4
33 POKE36874,C(A,C)
34 POKE36875,D(A,C):POKE36876,
   B(A,INT(RND(TI)*4+1)):GOSUB70
35 FORD=1TODEL:NEXT:POKE36874,
   0:POKE36875,0
36 NEXTC,B,A
37 GOTO30
40 POKE36879,8:PRINT"█▌    THE VIC BOOGIE"
50 PRINT"      ___ ___ ______"
60 PRINT"██BY:":PRINT"███A.MACIELINSKI":PRINT"
   ███████████____________________":RETURN
70 PRINT"███████████████████████";
71 IFC=1THENPRINT" ●███╱█╱█ ████ ████||";
72 IFC=2THENPRINT" ●███|█ █|████ ████╱ ╲";
73 IFC=3THENPRINT" ●███ █╲█╲████ ████||";
74 IFC=4THENPRINT" ●███|█ █|████ ████╱ ╲";
75 PRINT"TTT████";
76 IFC=1THENPRINT" ●███╱█ █╲████ █ █ ████╱ ╲████    "
77 IFC=2THENPRINT"  ███ ● █████ |█ █| █████ █ █ ████||"
78 IFC=3THENPRINT" ●███╱█ █╲████ █ █ ████╱ ╲████    "
79 IFC=4THENPRINT"  ███ ● █████ |█ █| █████ █ █ ████||"
80 RETURN
```



These driving barrelhouse boogies, penned by Adam Macielinski, take you for a stomp through the Vic's three music channels and show you how to orchestrate a full polyphonic sound to suit your musical tastes.

PLAY THAT BOOGIE

THE VIC has three sound generators: one bass, one tenor, and one soprano. Each generator can be used independently or together. Most of the time, only one, or even two generators are used. One good example of two sound generators working together is in Bug-Byte's Vicmen.

Here we shall delve in to the art of using three sound generators at the same time without creating discords. People with a musical ear should understand the method used very clearly. The method adopted is to set up a fixed left-hand section of the keyboard using the bass and tenor sound generators.

The notes for the left-hand voices are stored in a Dim statement. To make the left-hand less boring and monotonous three different keys have been used, but the chord played is still the same. Therefore a total of 12 different notes will be stored. In the first demonstration program — which includes a humorous animation — the set of chords is played twice and the third chord is in the same key as the first chord.

With each key played, four notes may be played to accompany the left-hand chords. In the key of C-major the notes for the right-hand are as follows — the right-hand column gives the value in the Vic manual.

```
10 HERE ARE SOME OF THE GRAPHICS AND CONTROL
20 CHARACTERS USED IN THE PROGRAM
30 "█" - COURSOR DOWN
50 "█" - CURSOR UP
60 "█" - CURSOR RIGHT
70 "█" - CURSOR LEFT
75 "█" - CURSOR HOME
77 "█" - CLR
78 "█" - REVERSE ON (CTRL + KEY9)
79 "█" - REVERSE OFF (CTRL + KEY0)
80 "█" - WHITE (CTRL + 2)
90 "█" - BLACK (CTRL + 1)
100 "█" - GREEN (CTRL + 6)
110 "█" - YELLOW (CTRL + 8)
120 "▗" - COMMODORE LOGO + KEY A
130 "▖" - COMMODORE LOGO + KEY D
140 "▙" - COMMODORE + KEY L
150 "▟" - COMMODORE + KEY M
160 "▔" - COMMODORE + KEY T
170 "▂" - COMMODORE + KEY O
180 "╱" - SHIFT + N
190 "╲" - SHIFT + M
200 "●" - SHIFT + Q
```

(continued on next page)

(continued from previous page)

Note	Value
C	225
E	231
G	235
top C	240

In both demonstration programs the right-hand notes are handled by a Dim statement and are played randomly by using

INT(RND(TI)*4) + 1

The TI ensures that a totally random number is produced. This method then produces a totally random tune together with the main left-hand chords, using all three sound generators.

The second demonstration program uses a more complicated set of chords which produces a mixture of two or three sound generators going on at once. This is because the first four notes in the left-hand Dim statement were all more than 0, whereas the rest of the Dim contained half 0s and half proper notes. This creates an interesting effect and the contrast between two-part harmony and three-part harmony shows well.

With a lot of experimentation — unless you have a piano or a similar instrument — you could produce your own tunes and left-hand chords. Perhaps you could even add a little white noise to the tune to give it an alien, sinister quality.

I would advise against turning up the volume too far: quite apart from the neighbours, the faithful old TV cannot stand the wear and tear that multi-harmony tunes can produce. So just remember to play it cool.

The second demonstration program.

```
1 DIMA(4,4),B(4,8),C(4,8)
2 DATA225,231,235,240,209,219,225,232,225,231,235,240,215,223,228,
235
3 FORA=1TO4
4 FORB=1TO4
5 READA(A,B)
6 NEXTB,A
7 FORA=1TO4
8 FORB=1TO8
9 READB(A,B),C(A,B)
10 NEXTB,A
11 DATA195,215,195,215,0,203,0,207,0,215,0,215,0,203,0,207
12 DATA209,225,209,225,0,217,0,219,0,225,0,225,0,217,0,219
13 DATA195,215,195,215,0,203,0,207,0,215,0,215,0,203,0,207
14 DATA175,201,175,201,0,187,0,191,0,201,0,201,0,187,0,191
20 POKE36879,8:PRINT"     VIC BOOGIE II":PRINT"                ——— ———— —"
21 PRINT"BY:":PRINT"A.MACIELINSKI":POKE36878,15:DEL=150
22 PRINT"——————————"
23 PRINT""
24 PRINT""
25 PRINT""
26 PRINT"TRASH BIN"
30 FORA=1TO4
31 FORB=1TO2
32 FORC=1TO8
33 POKE36874,B(A,C)
34 POKE36875,C(A,C)
35 POKE36876,A(A,INT(RND(TI)*4+1)):GOSUB40
36 FORF=1TODEL:NEXT
37 POKE36874,0:POKE36875,0
38 NEXTC,B,A
39 GOTO30
40 PRINT"";
41 IFC=1ORC=5THENPRINT" ●  /                |"
42 IFC=2ORC=6THENPRINT"●  _              \  \"
43 IFC=3ORC=7THENPRINT" ●  /             |  |"
44 IFC=4ORC=8THENPRINT" ●  |              /  /"
45 RETURN
```

Make much more of your computer!

More memory for your ZX81!

ZX-PANDA.

The uniquely expandable 16K RAM pack

The professionally produced 16K RAM Pack that is expandable to 32K simply by plugging-in our expansion module.
Start with 16K . . . expand later to 32K!
Solidly built, attractively cased to fit perfectly on to a ZX81 without wobble!
Includes LED power indicator.
The RAM pack that won't become redundant when you want more than 16K!

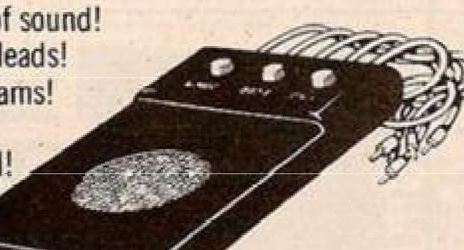


16K Expandable RAM. **£32.95**
16K Expansion Module **£19.95**

More sound from your ZX Spectrum!

Echo

Not only more sound, but better sound and a wide range of other facilities!
Control Volume, and adjust tone of sound!
Load and Save without switching leads!
Audible cue facility for tape programs!
DIN compatibility!
No additional power supply needed!
Attractively cased – looks good – SOUNDS GOOD!



Only £23.50

More memory for your Jupiter Ace

Pacer

New

The uniquely expandable 16K RAM pack

Similar concept to ZX-PANDA but for the incredible Jupiter Ace.
Attractive, solidly built 16K RAM pack with the facility of expanding to 32K by plug-in module.
For more power to faster FORTH . . . you need a PACER!

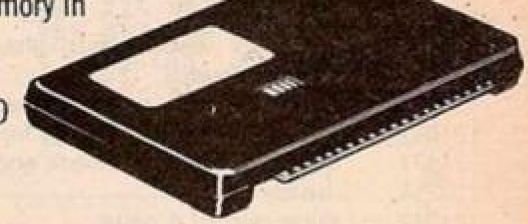


16K Expandable RAM **£29.95**
16K Expansion Module. **£19.95**

More memory for your VIC-20

Vixen RAM Cartridge for the VIC-20

Switchable between 16K or 8K + 3K.
Gives you the option of full 16K RAM or 8K and 3K RAM in one package. When added to a Standard VIC-20 gives 16384 bytes of extra memory in memory blocks 1 and 2 or 3092 bytes of extra memory into the 3K memory block AND 8192 bytes of extra memory switchable between memory blocks 1 and 3.



Fully compatible with available motherboards/modules.
Simply plugs into the rear expansion port of computer.
No re-addressing of existing BASIC programs needed. **Only £44.95**

Tandem

Expandable Expansion System for the VIC-20

Gives 4 expansion slots for VIC-20 cartridges.
Custom-designed case. Plugs directly into computer. Further expanded by using TANDEM System!
ROM socket for expansion.
No extra power supply needed.
Only £34.95



To: Stonechip Electronics, Unit 9, The Brook Industrial Estate, Deadbrook Lane, Aldershot, Hants. Telephone: (0252) 318260.
Please forward me the following products:

. . . .

. . . .

All prices are inclusive of VAT, Post & Packing for U.K. deliveries (overseas add 15%)

Name: . . . .

Address: . . . .

. . . .

STONECHIP ELECTRONICS

"more ways to make more of your computer"

Y

DEALER ENQUIRIES WELCOME Delivery approx 14 days

Figure 1. A listing of routines used in the machine code with the Start addresses. The machine code is in the form of a decimal dump in blocks of six bytes with the Start address of each block given.

Start address	Routine
29666	Check and accept 0-255 and Print keys pressed in Input lines.
29859	Pause until key pressed. Uses Halt command.
29871	Check last key press.
29900	Check number selected with menu options 1, 3 and 6.
29951	Main typewriter calls for un-shifted and single shifted keys.
29971	Double-shifted key calls.
29978	Print 8 × and 1 × size redefined characters.
30076	Print Spectrum and "new" redefined characters.
30157	Print "decimal-number" prompt.
30182	Print screen format for Redefine Mode.
30364	Print instructions routines.
30774	Data for sub-menu.
30821	Restore character mode in use.
30831	Print sub-menu.
30855	Data for menu.
30986	Print menu.
31013	Set screen and input lines bright.
31027	Erase-a-page start.
31038	Next page.
31067	Data for double-shift alternative character set.
31083	Store character mode in use.
31097	Normal and single-shifted key calls
31177	double-shifted key check and calls.
31214	Justify.
31242	Erase part of a page.
31293	Find cursor.
31316	Rubout.
31350	Justify subroutine.
31493/4/5	Spare.
31496	Data for Justify.
31500	Insert/delete.
31599	Spare.
31600	Find page.
31624	Erase a complete page.
31636	Print a page.
31664	Squeek.
31684	Buzz.
31710/11	Spare.
31712	New character set codes.
32481	Set parameters of page to be printed and call print page.
32489	Spare.
32490	Tap.
32500	Check character to be plotted.
32534	Plot character.
32573	Set Spectrum character mode.
32580	Set new character mode
32587-91	Spare.
32592	Set Over 1 for cursor.
32600	Plot cursor.
32651	Data for cursor position X,Y top left = 1,1.
32653	Cursor handling for Newline, Space, and put character plotted into x$ array.
32692-32767	Cursor keys check and move as required. Uses In function to read keys being pressed instead of Peeking Last Key 23560.
Data	
31616	Page number in use.
32501	Character code of key to be Plotted.
31529	Number of characters to be inserted or deleted.

THIS PROGRAM for the 16K Spectrum started out as a straightforward typewriter program in Basic with approximately 30 bytes of machine code to plot characters on to the screen in such a way as to give 42 characters per line. But the program was slow and used too much RAM, leaving little free for data storage.

The solution was to convert all the routines into machine code and maintain a minimum of four pages of data with 42 characters per line, this being the equivalent of five and a quarter pages of text if the normal 32 characters per line were used.

Up to this point I had been using the Spectrum character set, but the upper-case letters were touching each other and making the text illegible. I added a new character set with all the characters redefined on a six-by-eight pixel format. This created the option of using the Spectrum set or the new typewriter-mode set.

The program starts with the main Menu, which has six options.

The Start option takes you into the typewriter mode. It begins by asking for the page required and printing the selected page. This is done to avoid accidental overtyping of an existing page of text. A cursor is placed in the first character position at the top left of the screen, and can be moved to any position by means of Caps Shift and cursor controls: keys 5-8.

The cursor always indicates the position of the next character to be typed. If the cursor is moved over existing typing the character will change to white Ink and show through the cursor. If a character is overtyped, then it will be printed on top of the existing character, but the last character typed is held in the memory of the computer.

All Spectrum characters are available, using Shift keys as necessary, and all but the double-Shifted ones are auto-repeat.

Incorrect entries can be quickly erased by the use of Caps Shift and Delete. This will erase the character behind the cursor and backspace the cursor over the deleted character. At the start of a line it will erase the last character on the previous line and backspace on to that line. This function is also auto-repeat.

A Newline is obtained by pressing Enter, and this function will also auto-repeat. If the cursor is on line 22 then Enter will move the cursor to the end of line 22 where it is split into two, bracketing the last line, to indicate that the end of the page has been reached.

This method is used to erase the last character on a page, the cursor being in effect after the last character. There are several options available in this mode and, as a guide, these are indicated on line 24, with the keys necessary for each option shown in inverse video. The next options require both Shift keys to be pressed before the option letter. First, n(ext) will scroll the page off the screen and replace it with a copy of the next page. This can be used after finishing typing a page or to read through the pages. If you are on page 4 then the next page will be page 1. Second, m(enu) will take you back to the main Menu. Third, z is the copy key and, as it suggests it will copy the page on the screen to the printer.

A further facility is the Edit mode. This is accessed by Caps Shift and Edit, and when selected will give you five options. These will be printed on line 24 of the screen with the key presses for each option shown in inverse.

Insert — when selecting this option the cursor must be over the first character in the block to be Shifted right. You will be asked how many characters you require to be inserted; this must be in the range 0-255. The decimal number can be entered either with leading zeros like 032 or 006, in which case the Spectrum will atuomatically accept the number without the need for Enter, or as a "normal" number, that is, 32 or 6, in which case, if it is less than 100, the use of Enter is required. Each key press is checked, a buzz will sound if the entry is not valid and three questionmarks will be printed. A zero entry will skip this routine.

The Basic program.

```
  10 POKE 23606,1: RANDOMIZE USR
 31013: DIM x$(4,924): LET x=0:
LET t=50: LET v=23560: LET m=900
0: GO TO m
  50 RANDOMIZE USR 31083: INPUT
INKEY$: PRINT #x;"Page (";PEEK 3
1619;")  [illegible] : Menu:Next:Copy"
  55 RANDOMIZE USR 30821
  60 RANDOMIZE USR 29951
 140 IF PEEK v=7 AND PEEK 32651<
>43 THEN GO TO 700
 150 IF PEEK v<>14 THEN GO TO 60
 180 RANDOMIZE USR 29971
 230 IF PEEK v=CODE "n" THEN RAN
DOMIZE USR 31038: GO TO t
 250 IF PEEK v=CODE "m" THEN GO
TO m
 270 GO TO 60
 540 RANDOMIZE USR 31083: INPUT
INKEY$: PRINT #x;"HOW MANY Chrs.
 ?  ";
 570 RANDOMIZE USR 29566: RANDOM
IZE USR 30821: IF PEEK 29854=x T
HEN GO TO 780
 600 RANDOMIZE USR 31500: GO TO
t
 700 RANDOMIZE USR 32592
 710 RANDOMIZE USR 31083: INPUT
INKEY$: PRINT #x;"Insert:Delete:
Erase:JUSTIFY  ,L/ "
 730 RANDOMIZE USR 30821: PAUSE
x: IF PEEK v=CODE "i" THEN POKE
31544,10: GO TO 540
 740 IF PEEK v=CODE "d" THEN POK
E 31544,x: GO TO 540
 750 IF PEEK v=CODE "e" THEN RAN
DOMIZE USR 31242: GO TO 780
 760 IF PEEK v=CODE "l" THEN POK
E 31412,79: GO TO 8000
 770 IF PEEK v=CODE "r" THEN POK
E 31412,x: GO TO 8000
 780 RANDOMIZE USR 32592: GO TO
t
1000 RANDOMIZE USR 29900: GO TO
t
2000 RANDOMIZE USR 30434: STOP
2010 GO TO m
3000 RANDOMIZE USR 29915
3020 IF PEEK v>CODE "4" THEN GO
TO m
3050 RANDOMIZE USR 30545: GO TO
5020
4000 RANDOMIZE USR 30615: INPUT
i$
4010 PRINT AT 11,x;"SAVING: """;
i$;""" DATA x$()": SAVE i$ DATA
x$(): GO TO 5020
5000 RANDOMIZE USR 30674: INPUT
i$
5010 RANDOMIZE USR 30720: PAUSE
x: LOAD i$ DATA x$()
5020 RANDOMIZE USR 30756: PAUSE
x: GO TO m
6000 RANDOMIZE USR 29927
6030 IF PEEK v=CODE "1" THEN RAN
DOMIZE USR 32573: GO TO m
6050 IF PEEK v=CODE "2" THEN RAN
DOMIZE USR 32580: GO TO m
6055 RANDOMIZE USR 30200
6060 INPUT i$
6080 IF LEN i$>1 OR i$<" " OR i$
>"©" THEN RANDOMIZE USR 31684: G
O TO 6060
6085 POKE 30177,CODE i$
6090 RANDOMIZE USR 30076
6100 FOR b=1 TO 8
6110 RANDOMIZE USR 30157
6140 RANDOMIZE USR 29666: RANDOM
IZE USR 29978: NEXT b
6190 PRINT #x;"O.K.?   Repeat :
Other keys MENU": RANDOMIZE USR
30821: PAUSE x: IF INKEY$="r" TH
EN CLS : GO TO 6055
6200 GO TO m
8000 RANDOMIZE USR 31083: INPUT
INKEY$: PRINT #x;"Page OR Cursor
 line ?"
8020 RANDOMIZE USR 30821: PAUSE
x: IF PEEK v=CODE "c" THEN RANDO
MIZE USR 31214: GO TO t
8030 IF PEEK v=CODE "p" THEN RAN
DOMIZE USR 31225: GO TO t
8040 GO TO 780
9000 RANDOMIZE USR 29939: GO TO
1e3*(PEEK v-48)
9800 CLEAR 29665: LOAD ""CODE 29
666: GO TO 10
9900 SAVE "type" LINE 9800: SAVE
 ""CODE 29666,3102
```

The maximum number of characters that can be inserted is one less than the number of characters from the cursor to the end of the page if this is less than 255.

Any character pushed off the page by this routine will be lost. After a number has been accepted the page will scroll off the screen and be replaced instantly with the modified page and the cursor, still in its original position, so that the required information can be typed in.

Delete — this option is similar to Insert in that the cursor is placed over the first character in the block to be deleted, and you will be asked how many characters you require deleting before the page is scrolled off the screen and reprinted with the correction made.

The Erase option will erase part of a page reaching from the end of the page to the line below the cursor. So the cursor must be placed on the last line of typing that you wish to keep before this option is called. The erased part of the page will scroll up and off the screen; the retained part stays in position.

Justify — there are two Justify options, with both you have a further choice of justifying the whole page or the cursor line only. So if only the cursor line is required, be sure to place the cursor anywhere on the required line before this mode is selected. Justify left will scroll the page off the screen and reprint it with the line or page shifted to the left-hand margin. Justify left/right will scroll the page off the screen and reprint it with the line or page shifted left and the space between words padded out so that the last letter of the last word in each line is at the right-hand margin.

These last options can be skipped if the Edit mode is accidentally selected by pressing any other key. The Edit mode cannot be selected with the cursor at the end of the page.

The Stop command stops the program with the usual report and a message that "Continue will restart at Menu". If the program is broken then Goto 9000 will also restart at the menu. If Run is used then all existing typing will be erased.

The Erase-a-page option will ask which page is to be deleted. Any choice other than 1-4 will take you back to the menu. The page selected will be instantly erased.

Pages can be Loaded and Saved on tape with appropriate options. You will be asked to name the pages when Loading and Saving; the usual rule of 10 characters maximum applies.

The Change-typeface option will give you three options: Normal, New and Redefine.

Normal gives typing with the Spectrum characters, but because of the squashed look of the eight-by-eight pixel format, certain characters will look odd.

New: because of the problems outlined above, a new keyboard has been defined to give a six-by-eight character set. When this mode is selected, all typing on the Spectrum will use the new characters, the program listing may be shown in the new characters, but instructions and menus will still use the Spectrum set.

Redefine: any character in the new set can be redefined with this option. The Spectrum will require the character to be redefined and the decimal number of lines 1-8 of the new character. A display will be given showing the Spectrum character selected with the new character beside it; above this will be a grid with lines 1 to 8 and columns a to f indicated. As each decimal number is entered the character will be shown magnified on this grid and the actual size character will alter its shape accordingly.

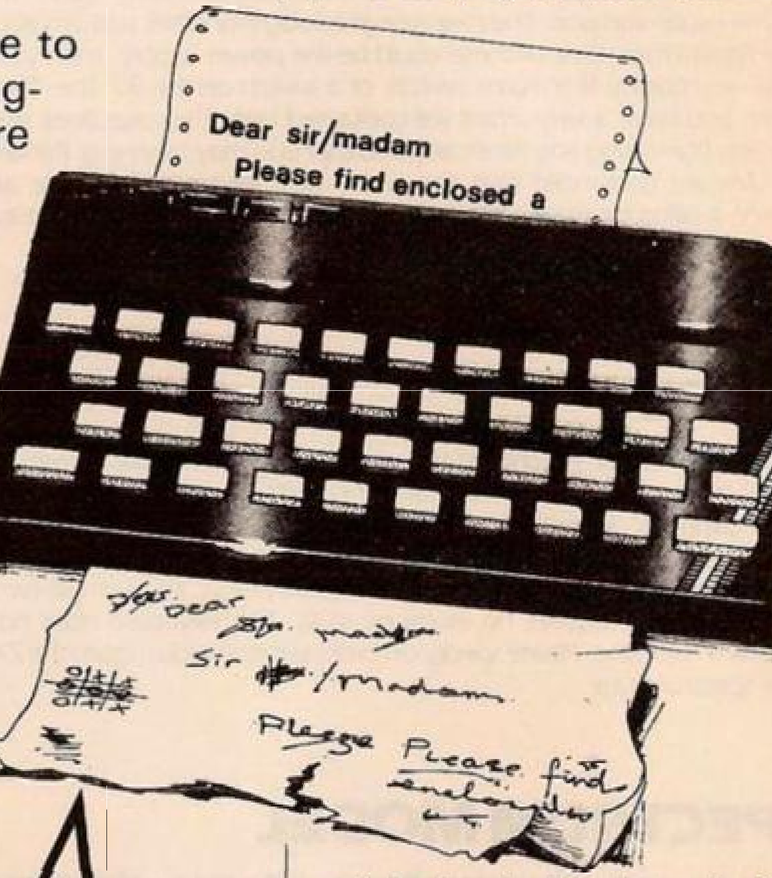
The character grid is in two colours, yellow and green; the yellow area indicates six columns a to f, and any redefined character should stay within this area as it is only this part of the character that is plotted on the screen.

With this routine the whole keyboard could be redefined to suit your needs. If you want to retain your redefined keyboard then the word processor program will need to be reSaved with the command Goto 9900.

The Spectrum will either buzz if an

(continued on page 88)

Now's the time to tackle that long-deferred oeuvre with Stuart Nicholls' fast machine-code word processor



WORDS ON THE SPECTRUM

Figure 2.

```
  = 0,0,0,0,0,0,0,0,
! = 16,16,16,16,0,16,0,0,
" = 20,20,0,0,0,0,0,0,
# = 0,40,124,40,124,40,0,0,
$ = 16,56,80,56,20,120,16,0,
% = 0,100,104,16,44,76,0,0,
& = 32,80,32,84,72,52,0,0,
' = 16,16,0,0,0,0,0,0,
( = 8,16,16,16,16,8,0,0,
) = 32,16,16,16,16,32,0,0,
* = 0,40,16,124,16,40,0,0,
+ = 0,16,16,124,16,16,0,0,
, = 0,0,0,0,8,8,16,0,
- = 0,0,0,124,0,0,0,0,
. = 0,0,0,0,16,16,0,0,
/ = 0,4,8,16,32,64,0,0,
0 = 56,76,84,84,100,56,0,0,
1 = 16,48,16,16,16,56,0,0,
2 = 56,68,8,16,32,124,0,0,
3 = 120,4,56,4,4,120,0,0,
4 = 64,72,72,124,8,8,0,0,
5 = 124,64,120,4,4,120,0,0,
6 = 56,64,120,68,68,56,0,0,
7 = 124,4,4,8,16,32,0,0,
8 = 56,68,56,68,68,56,0,0,
9 = 56,68,68,60,4,56,0,0,
: = 0,16,16,0,16,16,0,0,
; = 0,16,16,0,16,16,32,0,
< = 0,16,32,64,32,16,0,0,
= = 0,0,124,0,124,0,0,0,
> = 0,16,8,4,8,16,0,0,
? = 56,68,8,16,0,16,0,0,
@ = 56,76,84,92,64,56,0,0,
A = 56,68,68,124,68,68,0,0,
B = 120,68,120,68,68,120,0,0,
C = 56,68,64,64,68,56,0,0,
D = 120,68,68,68,68,120,0,0,
E = 124,64,120,64,64,124,0,0,
F = 124,64,120,64,64,64,0,0,
G = 56,68,64,92,68,56,0,0,
H = 68,68,124,68,68,68,0,0,
I = 56,16,16,16,16,56,0,0,
J = 28,8,8,8,72,48,0,0,
K = 72,80,96,80,72,68,0,0,
L = 64,64,64,64,64,124,0,0,
M = 68,108,84,68,68,68,0,0,
N = 68,100,84,76,68,68,0,0,
O = 56,68,68,68,68,56,0,0,
P = 120,68,68,120,64,64,0,0,
Q = 56,68,68,68,84,56,4,0,
R = 120,68,68,120,72,68,0,0,
S = 56,64,56,4,68,56,0,0,
T = 124,16,16,16,16,16,0,0,
U = 68,68,68,68,68,56,0,0,
V = 68,68,68,68,40,16,0,0,
W = 68,68,84,84,108,40,0,0,
X = 68,40,16,16,40,68,0,0,
Y = 68,40,16,16,16,16,0,0,
Z = 124,8,16,32,64,124,0,0,
[ = 48,32,32,32,32,48,0,0,
\ = 0,64,32,16,8,4,0,0,
] = 24,8,8,8,8,24,0,0,
↑ = 16,56,84,16,16,16,0,0,
_ = 0,0,0,0,0,0,0,252,
£ = 24,36,32,112,32,32,124,0,
a = 0,56,4,60,68,60,0,0,
b = 64,120,68,68,68,120,0,0,
c = 0,60,64,64,64,60,0,0,
d = 4,60,68,68,68,60,0,0,
e = 0,56,68,120,64,56,0,0,
f = 24,36,32,120,32,32,0,0,
g = 0,56,68,68,68,60,4,56,
h = 64,120,68,68,68,68,0,0,
i = 16,0,48,16,16,56,0,0,
j = 16,0,48,16,16,16,80,32,
k = 64,64,72,112,72,68,0,0,
l = 64,64,64,64,68,56,0,0,
m = 0,40,84,84,84,84,0,0,
n = 0,120,68,68,68,68,0,0,
o = 0,56,68,68,68,56,0,0,
p = 0,120,68,68,68,120,64,64,
q = 0,60,68,68,68,60,4,4,
r = 0,56,68,64,64,64,0,0,
s = 0,56,64,56,4,120,0,0,
t = 32,120,32,32,36,24,0,0,
u = 0,68,68,68,68,60,0,0,
v = 0,68,68,68,40,16,0,0,
w = 0,84,84,84,84,40,0,0,
x = 0,68,40,16,40,68,0,0,
y = 0,68,68,68,68,60,4,56,
z = 0,124,8,16,32,124,0,0,
{ = 48,32,32,64,32,32,48,0,
| = 16,16,16,16,16,16,0,0,
} = 24,8,8,4,8,8,24,0,
~ = 0,0,52,88,0,0,0,0,
© = 112,136,232,200,232,136,112,
0,
```

d.k.tronics

ZX KEYBOARD FOR USE WITH 80/81 SPECTRUM

Our new cased keyboard has 52 keys, 12 of these are used for the numeric pad. The numeric pad offers some useful features, you can cursor with one hand and it will be a boon for anyone who enters a lot of numeric data. The pad is a repeat of the 1-9 keys plus it has a full stop and a shift key. The numeric pad keys are coloured in red, the normal keyboard keys are grey, with the case being black which makes the whole thing very attractive. The case measures 15 × 9 × 2½. The computer (either 80/81 or spectrum) fits neatly inside. You will have to remove the computer from its original case, it is then screwed to the base of the case. The case had all the bosses already fitted and the screw holes are marked. Also fitted inside the case is a mother board (81 model only) which allows 16K, 32K and 64K to be fitted in the case. All the connections are at the rear of the case i.e. Power, Mic, Ear, T.V. and the expansion port. The case is large enough for other add ons also to be fitted inside. One of these could be the power supply, then you could very quickly fit a mains switch, or a switch on the 9V line. This means you have a very smart self-contained unit. This case does not stop you from using any other add-ons that you may have e.g. Printer etc. We are convinced that this is the best keyboard available at present. It offers more keys and features than any other keyboard in its price range.

£45



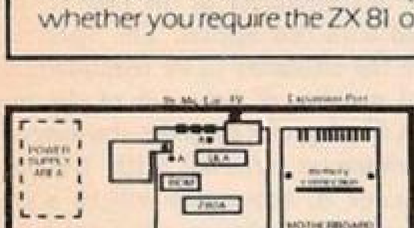
KEYBOARD (SPECTRUM/81)

NOTE

The case can be purchased separately with the keyboard aperture uncut, so if you have one of our early uncased keyboards, or in fact any other suppliers' keyboards, these could be fitted. The keyboard is connected to your computer by a ribbon cable and this has connectors fitted which simply push into the Sinclair connectors. It is a simple two minute job and requires no electronic skills. This keyboard does not need any soldering. Please specify on order whether you require the ZX 81 or Spectrum case.

SPECTRUM MODEL

This is supplied with spectrum legends, and a slightly different base for fitting the spectrum inside, again all the connectors are at the rear of the case and there is plenty of room for the power supply (and other add-ons). Should you want to change, we can supply both the Spectrum legends and details of updating your case which will enable modification from the ZX 81 to spectrum. PLEASE specify on your order whether you require the ZX 81 or spectrum case.



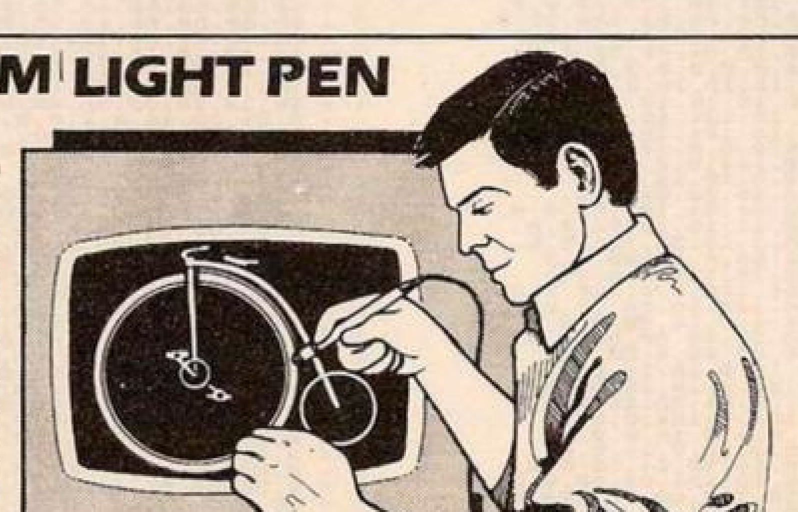
Internal fixing for ZX 81 keyboard case.



Internal fixing for spectrum keyboard case.

SPECTRUM LIGHT PEN

The pen enables you to produce high resolution drawings on your own television set, saving a vast amount of time over using basic programming statements, such as Plot, Draw etc. You can erase, modify and save drawings and it comes complete with software program. The superb light pen is available from D.K. tronics.



£19.95

SPECTRU

16K Memory Exp

The 16K uses 4116
Static Ram and occu
using the Static Ram
speed low power Ra
the computer. All t
which comes to you
where. Position in r

64K Memory Exp

All the above inform
advantage lies in the
56K of usable memo
the use of other add
8192-65536. The Blo

Spectrum Memory

Upgrade your Spectr
it is simply slipped ins
are supplied, and th
time. The fitting requ
same as Sinclair's up

(continued from page 85)
incorrect option is chosen, or repeat the prompt, or skip the routine being called. A squeak will sound each time a menu option is chosen and valid entry made. In the Typewriter mode a key tap will sound with each key press.

To load the program Enter the Basic program and Save it by Goto 9900; this will auto-run the program when complete. Stop the tape at the second Start tape prompt and Verify the Basic before Newing it.

Enter your favourite machine-code loader, Clear 29665 and enter the machine code. Save this immediately after the Basic program using

SAVE "spc."CODE 29666,3102

and Verify.

Rewind to the start of the Basic program and Load "type". This will then load the Basic, the machine code and auto-run. The first thing to appear on the screen will be the main menu.

If any section of the program fails to run then, using the list of routines and addresses, you should be able to check the machine code. I have purposely kept some of the program in Basic so that you may follow it more easily. It would be a simple task to convert all of option 1 and option 6 to machine code.

The routine starting at 29666 shows how to clear the Input lines 23 and 24 and which channel to open so that printing can be displayed on these lines. The Basic input Inkey$ can be replaced by a call to the ROM routine to clear the input lines, and the Basic

PRINT # x;"********"

can be replaced by Open Channel and Print String ROM calls. The rest of option 1 is then a straightforward case of checking which keys are being pressed by Peeking the variable Last Key at address 23560 and making the necessary jumps, and calls. For example, line 230:

```
      LD A, (23560)
      CP "n"
      JR NZ,NEXT
      CALL 31038
      JR LINE 50
NEXT  CP "m"
      RET Z
      JR LINE 60
```

The only time a Ret to Basic would be made is when the Menu option is chosen, so line 1000 would become;

1000 RANDOMIZE USR 'START ADDRESS' : GO TO m

and lines 50 to 780 and 8000 to 8040 could then be deleted. This would also have the benefit of making the Break key inoperable in the typewriter mode which can be annoying if Caps Shift and Space are pressed by mistake.

The machine-code dump.

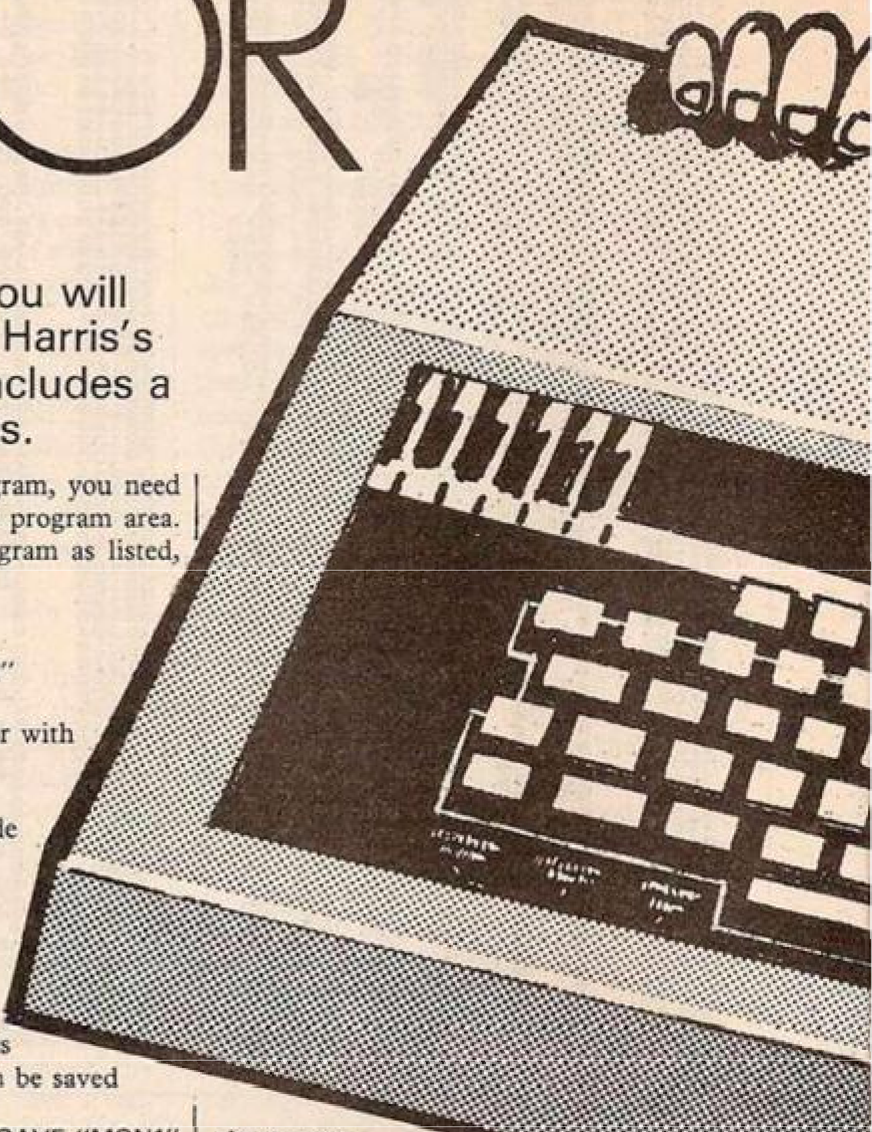
29666	42	134	92	34	159	116
29672	42	136	92	34	161	116
29678	33	155	116	6	1	229
29684	197	205	163	116	193	225
29690	58	6	92	254	13	40
29696	29	119	214	46	56	126
29702	214	16	46	128	197	229
29708	62	253	205	1	22	225
29714	229	126	215	225	193	35
29720	4	120	254	4	32	213
29726	5	40	99	43	126	214
29732	48	50	158	116	5	40
29738	54	43	126	214	48	135
29744	79	135	135	129	79	58
29750	158	116	129	50	158	116
29756	5	40	34	43	126	214
29762	48	40	28	254	1	32
29768	4	14	100	24	13	254
29774	2	32	51	56	156	116
29780	214	56	48	44	14	200
29786	58	158	116	129	50	158
29792	116	58	158	116	50	41
29798	123	50	226	117	205	176
29804	123	6	32	116	16	253
29810	6	2	205	68	14	42
29816	159	116	34	134	92	42
29822	161	116	34	136	92	201
29828	205	196	123	205	119	116
29834	62	253	205	1	22	175
29840	215	175	215	175	215	205
29846	119	116	195	226	115	48
29852	48	48	0	243	60	14
29858	23	110	253	203	1	110
29864	40	249	253	203	1	174
29870	201	205	196	123	205	163
29876	116	56	6	92	214	43
29882	56	243	33	203	116	150
29888	48	237	6	24	205	68
29894	14	205	176	123	201	6
29900	205	174	118	62	4	50
29906	203	116	205	178	116	205
29912	225	126	201	205	43	119
29918	62	255	50	203	116	205
29924	178	116	201	205	111	120
29930	62	3	50	203	116	205
29936	178	116	201	205	10	121
29942	62	6	50	203	116	205
29948	178	116	201	205	50	127
29954	205	163	116	205	121	121
29960	58	8	92	254	12	192
29966	205	204	126	24	239	205
29972	163	116	205	201	121	201
29978	205	68	127	42	228	117
29984	58	226	117	119	35	34
29990	228	117	62	2	205	1
29996	22	62	22	215	62	15
30002	215	62	19	215	62	21
30008	215	175	215	58	225	117
30014	215	58	183	117	60	50
30020	183	117	58	226	117	135
30026	50	226	117	48	22	62
30032	2	205	1	22	62	22
30038	215	58	183	117	215	58
30044	227	117	215	62	143	215
30050	205	234	126	58	227	117
30056	60	254	19	40	8	50
30062	227	117	58	226	117	24
30068	212	205	113	121	205	176
30074	123	201	175	50	183	117
30080	17	224	122	38	0	58
30086	225	117	111	41	41	41
30092	25	34	228	117	62	2
30098	205	1	22	62	22	215
30104	62	15	215	62	15	215
30110	58	225	117	215	205	68
30116	127	62	22	215	62	15
30122	215	62	19	215	58	225
30128	117	215	205	113	121	201
30134	22	8	0	32	32	32
30140	32	32	32	32	32	32
30146	13	32	68	69	67	46
30152	32	76	111	46	62	62
30158	2	205	1	22	17	182
30164	117	1	23	0	205	60
30170	32	62	11	50	227	117
30176	201	32	0	18	232	123
30182	16	0	22	8	10	48
30188	16	6	143	143	143	143
30194	143	143	16	5	143	143
30200	205	197	121	62	2	205
30206	1	22	6	8	197	58
30212	233	117	60	50	233	117
30218	58	235	117	60	50	235
30224	117	17	230	117	1	18
30230	0	205	60	32	193	16
30236	229	175	50	233	117	62
30242	48	50	235	117	24	101
30248	16	0	22	11	11	78
30254	69	87	32	120	56	22
30260	9	11	97	98	99	100
30266	101	102	22	15	1	83
30272	80	69	67	84	82	85
30278	77	32	67	72	82	46
30284	32	63	32	61	32	32
30290	32	39	78	69	87	39
30296	32	77	79	68	59	22
30302	1	20	97	61	49	50
30308	56	22	2	20	98	61
30314	32	54	52	22	3	20
30320	99	61	32	51	50	22
30326	4	20	100	61	32	49
30332	54	22	5	20	101	61
30338	32	32	56	22	6	20
30344	102	61	32	32	52	62
30350	2	205	1	22	17	40
30356	118	1	101	0	205	60
30362	32	201	22	11	8	80
30368	65	71	69	32	82	69
30374	81	85	73	82	69	68
30380	32	63	62	2	205	1
30386	22	17	156	118	1	18
30392	0	205	60	32	205	101
30398	120	201	22	11	0	67
30404	79	78	84	73	78	85
30410	69	32	58	32	119	105
30416	108	108	32	114	101	115
30422	116	97	114	116	32	97
30428	116	32	77	69	78	85
30434	62	2	205	1	22	17
30440	192	118	1	34	0	205
30446	60	32	205	101	120	201
30452	22	11	2	80	65	71
30458	69	32	78	111	46	32
30464	116	111	32	98	101	32
30470	69	82	65	83	69	68
30476	32	49	45	52	32	63
30482	22	13	5	65	78	89
30488	32	79	84	72	69	82
30494	32	75	69	89	32	70
30500	79	82	32	77	69	78
30506	85	62	2	205	1	22
30512	17	244	118	1	55	0
30518	205	60	32	205	101	120
30524	201	22	15	7	80	65
30530	71	69	32	78	79	46
30536	32	32	32	69	82	65
30542	83	69	68	205	51	121
30548	205	107	121	62	2	205
30554	1	22	17	61	119	1
30560	20	0	205	60	32	62
30566	22	215	62	15	215	62
30572	16	215	58	131	123	198
30578	48	215	201	22	9	0
30584	84	73	84	76	69	32
30590	111	102	32	80	65	71
30596	69	83	32	40	49	48
30602	32	67	104	114	115	46
30608	32	77	65	88	41	32
30614	63	62	2	205	1	22
30620	17	117	119	1	34	0
30626	205	60	32	201	22	11
30632	0	84	73	84	76	69
30638	32	111	102	32	80	65
30644	71	69	83	32	116	111
30650	32	98	101	32	76	79
30656	65	68	69	68	8	34
30662	83	34	32	68	65	84
30668	65	32	68	36	40	41
30674	62	2	205	1	22	17
30680	166	119	1	44	0	205
30686	60	32	201	22	15	0
30692	83	119	105	116	99	104
30698	32	111	110	32	116	97
30704	112	101	32	38	32	112
30710	114	101	115	115	32	69
30716	78	84	69	82	62	2
30722	205	1	22	17	225	119
30728	1	31	0	205	60	32
30734	201	22	17	7	79	46
30740	107	46	32	80	82	69
30746	83	83	32	65	78	89
30752	32	75	69	89	62	2
30758	205	1	22	17	15	120
30764	1	21	0	205	60	32
30770	205	101	120	201	22	5
30776	14	77	69	78	85	22
30782	7	5	49	41	32	39
30788	78	79	82	77	65	76
30794	39	22	9	5	50	41
30800	32	39	78	69	87	39
30806	22	11	5	51	41	32
30812	32	82	69	68	69	70
30818	73	78	69	42	176	92
30824	34	54	92	201	0	0
30830	0	62	2	205	1	22
30836	6	24	205	60	14	17
30842	54	120	1	47	0	205
30848	60	32	0	205	101	120
30854	201	22	0	14	77	69
30860	78	85	22	2	5	49
30866	41	32	83	84	65	82
30872	84	22	4	5	50	41
30878	32	83	84	79	80	22
30884	6	5	51	41	32	69
30890	82	65	83	69	32	65
30896	32	80	65	71	69	22
30902	8	5	52	41	32	83
30908	65	86	69	32	80	65
30914	71	69	83	22	10	5
30920	53	41	32	76	79	65
30926	68	32	80	65	71	69
30932	83	22	12	5	54	41
30938	32	67	72	65	78	71
30944	69	32	84	89	80	69
30950	70	65	67	69	22	20
30956	5	127	32	49	57	56
30962	50	32	83	116	117	97
30968	114	116	32	76	105	99
30974	104	111	108	108	115	22
30980	16	14	95	95	95	95
30986	205	107	121	62	2	205
30992	1	22	6	24	205	68
30998	14	17	135	120	1	131
31004	0	205	60	32	0	0
31010	0	0	201	62	120	50
31016	72	92	33	141	92	203
31022	246	205	61	127	201	58
31028	8	92	214	48	50	131
31034	123	195	136	123	58	8
31040	92	254	110	192	58	131
31046	123	60	254	6	32	2
31052	62	1	50	131	123	205
31058	89	123	33	1	1	34
31064	139	127	201	121	91	117
31070	93	112	127	97	126	115
31076	124	100	92	102	123	103
31082	125	42	54	92	34	176
31088	92	33	0	60	34	54
31094	92	201	0	205	60	127
31100	58	8	92	50	245	126
31106	254	13	32	4	205	141
31112	127	201	58	139	127	254
31118	43	40	41	58	245	126
31124	254	32	32	4	205	153
31130	127	201	214	32	56	26
31136	214	96	208	58	145	92
31142	203	135	50	145	92	205
31148	244	126	58	145	92	203
31154	199	50	145	92	205	146
31160	127	201	58	245	126	254
31166	12	32	4	205	84	122
31172	201	205	180	127	201	58
31178	139	127	254	43	200	58
31184	8	92	33	91	121	1
31190	16	0	237	177	120	177
31196	40	6	126	50	245	126
31202	24	191	58	8	92	254
31208	122	192	205	172	14	201
31214	58	140	127	50	125	122
31220	205	118	122	24	13	62
31226	22	245	50	125	122	205
31232	118	122	241	61	32	245
31238	205	89	123	201	205	112
31244	123	229	175	237	82	237
31250	75	139	127	17	42	0
31256	25	16	253	235	225	237
31262	82	235	122	179	200	35
31268	54	32	27	122	179	32
31274	248	42	139	127	62	23
31280	148	71	79	12	197	205
31286	0	14	193	13	32	248
31292	201	205	112	123	175	237
31298	82	237	75	139	127	17
31304	42	0	25	16	253	237
31310	82	35	13	32	252	201
31316	42	139	127	43	32	0
31322	46	42	37	32	3	33
31328	1	1	34	139	127	205
31334	61	122	54	32	58	145
31340	92	203	135	50	145	92
31346	205	88	127	201	205	112
31352	123	175	237	82	6	1
31358	17	42	0	25	16	253
31364	34	8	123	237	82	35
31370	34	10	123	1	0	42
31376	128	254	32	32	5	12
31382	35	16	247	201	120	6
31388	0	237	91	10	123	79
31394	237	176	42	8	123	71
31400	62	42	144	40	6	71
31406	54	32	43	16	251	24
31412	0	42	10	123	6	41
31418	35	126	254	32	40	8
31424	16	248	35	126	254	32
31430	32	4	16	248	24	56
31436	42	8	123	126	254	32
31442	32	46	42	10	123	1
31448	42	0	13	40	247	35
31454	126	254	32	40	247	43
31460	126	254	32	32	22	197
31466	229	42	8	123	229	209
31472	43	237	184	42	8	123
31478	126	254	32	32	7	229
31484	193	13	35	35	24	216
31490	225	225	201	0	0	0
31496	181	101	140	101	205	104
31502	123	229	175	237	82	17
31508	42	0	1	17	22	25
31514	16	253	237	82	35	13
31520	32	252	209	213	229	235
31526	237	82	17	0	0	35
31532	237	82	40	2	48	3
31538	225	225	201	229	193	24
31544	10	209	42	41	123	25

31550	237	176	225	24	13	225
31556	209	43	229	9	237	184
31562	225	237	91	41	123	25
31568	58	41	123	54	32	43
31574	61	32	250	6	24	197
31580	6	23	205	0	14	193
31586	16	247	205	148	123	201
31592	205	80	127	205	112	123
31598	201	0	42	75	92	126
31604	254	216	40	3	35	24
31610	248	17	7	0	25	17
31616	156	3	6	1	25	16
31622	253	201	205	112	123	54
31628	32	43	27	122	179	32
31634	248	201	205	112	123	6
31640	22	14	42	126	50	245
31646	126	237	67	26	127	229
31652	197	205	244	126	193	225
31658	40	13	32	237	16	233
31664	33	40	0	17	15	0
31670	229	205	161	3	225	17
31676	1	0	167	237	82	32
31682	240	201	6	50	197	33
31688	0	1	17	1	0	229
31694	205	161	3	225	17	16
31700	0	167	237	82	32	240
31706	193	16	233	201	0	0
31712	0	0	0	0	0	0
31718	0	0	16	16	16	16
31724	0	16	0	0	20	20
31730	0	0	0	0	0	0
31736	0	40	124	40	124	40
31742	0	0	16	56	80	56
31748	20	120	16	0	0	100
31754	104	16	44	76	0	0
31760	32	80	32	84	72	52
31766	0	0	16	16	0	0
31772	0	0	0	0	0	16
31778	16	16	16	0	0	0
31784	32	16	16	16	16	32
31790	0	0	0	40	16	124
31796	16	40	0	0	0	16
31802	16	124	16	16	0	0
31808	0	0	0	0	0	0
31814	16	0	0	0	0	124
31820	0	0	0	0	0	0
31826	0	0	16	16	0	0
31832	0	4	8	16	32	64
31838	0	0	56	76	84	84
31844	100	56	0	8	40	16
31850	16	16	16	56	0	0
31856	56	68	8	16	32	124
31862	0	0	120	4	56	4
31868	4	120	0	0	64	72
31874	72	124	8	8	0	0
31880	124	64	120	4	4	120
31886	0	0	56	64	120	68
31892	68	56	0	0	124	4
31898	4	8	16	32	0	0
31904	56	68	56	68	68	56
31910	0	0	56	68	68	60
31916	4	56	0	0	0	16
31922	16	0	16	16	0	0
31928	0	16	16	0	16	32
31934	32	0	0	16	32	64
31940	32	16	0	0	0	0
31946	124	0	124	0	0	0
31952	0	16	8	4	8	16

31958	0	0	56	68	8	16
31964	0	16	0	0	56	76
31970	84	92	64	56	0	0
31976	56	68	68	124	68	68
31982	0	0	120	68	120	68
31988	68	120	0	0	56	68
31994	64	64	68	56	0	0
32000	120	68	68	68	68	120
32006	0	0	124	64	120	64
32012	64	124	0	0	124	64
32018	120	64	64	64	0	0
32024	56	68	64	92	68	56
32030	0	0	68	68	124	68
32036	68	68	0	0	56	16
32042	16	16	16	56	0	0
32048	28	8	8	8	72	48
32054	0	0	72	80	96	80
32060	72	68	0	0	64	64
32066	64	64	64	124	0	0
32072	68	108	84	68	68	68
32078	0	0	68	100	84	76
32084	68	68	0	0	56	68
32090	68	68	68	56	0	0
32096	120	68	68	120	64	64
32102	0	0	56	68	68	68
32108	84	56	4	0	120	68
32114	68	120	72	68	0	0
32120	56	64	56	4	68	56
32126	0	0	124	16	16	16
32132	16	16	0	0	68	68
32138	68	68	68	56	0	0
32144	68	68	68	68	40	16
32150	0	0	68	68	84	84
32156	108	40	0	0	68	40
32162	16	16	40	68	0	0
32168	68	40	16	16	16	16
32174	0	0	124	8	16	32
32180	64	124	0	0	48	32
32186	32	32	32	48	0	0
32192	0	64	32	16	8	4
32198	0	0	24	8	8	8
32204	8	24	0	0	16	56
32210	84	16	16	16	0	0
32216	0	0	0	0	0	0
32222	0	252	24	36	32	112
32228	32	32	124	0	0	56
32234	4	60	68	60	0	0
32240	64	120	68	68	68	120
32246	0	0	0	60	64	64
32252	64	60	0	0	4	60
32258	68	68	68	60	0	0
32264	0	56	68	120	64	56
32270	0	0	24	36	32	120
32276	32	32	0	0	0	56
32282	68	68	68	60	4	56
32288	64	120	68	68	68	68
32294	0	0	16	0	48	16
32300	16	56	0	0	16	0
32306	48	16	16	16	80	32
32312	64	64	72	112	72	68
32318	0	0	64	64	64	64
32324	68	56	0	0	0	40
32330	84	84	84	84	0	0
32336	0	120	68	68	68	68
32342	0	0	0	56	68	68
32348	68	56	0	0	0	120
32354	68	68	68	120	64	64
32360	0	60	68	68	60	60

32366	4	4	0	56	68	64
32372	64	64	0	0	0	56
32378	64	56	4	120	0	0
32384	32	120	32	32	36	24
32390	0	0	0	68	68	68
32396	68	60	0	0	0	68
32402	68	60	40	16	0	0
32408	0	84	84	84	84	40
32414	0	0	0	68	40	16
32420	40	68	0	0	0	68
32426	68	68	68	60	4	56
32432	0	124	8	16	32	124
32438	0	0	40	32	32	64
32444	32	32	48	0	16	16
32450	16	16	16	16	0	0
32456	24	8	8	4	8	8
32462	24	0	0	0	52	88
32468	0	0	0	0	112	136
32474	232	200	232	136	112	0
32480	0	58	0	92	214	48
32486	195	78	121	0	17	1
32492	0	33	50	0	205	161
32498	3	201	33	14	0	41
32504	41	41	237	91	54	92
32510	25	6	8	14	6	86
32516	123	61	32	2	203	34
32522	203	34	220	22	127	13
32528	32	248	35	16	236	201
32534	197	213	229	33	17	22
32540	45	175	125	7	7	133
32546	133	111	203	36	203	36
32552	203	36	62	175	148	103
32558	62	6	145	133	79	120
32564	132	71	205	229	34	225
32570	209	193	201	33	1	60
32576	34	54	92	201	33	224
32582	122	34	54	92	201	0
32588	0	0	0	0	58	145
32594	92	203	199	50	145	92
32600	175	58	140	127	7	7
32606	7	71	62	183	144	71
32612	22	0	58	139	127	61
32618	79	7	7	129	129	79
32624	30	6	213	197	205	229
32630	34	193	209	12	29	32
32636	245	5	21	32	229	42
32642	139	127	34	25	127	34
32648	23	123	201	17	22	42
32654	139	127	24	16	205	61
32660	122	58	245	126	119	42
32666	139	127	44	125	254	43
32672	32	11	46	1	36	124
32678	254	23	32	3	33	43
32684	22	34	139	127	205	234
32690	126	201	1	254	254	237
32696	120	254	254	192	42	139
32702	127	1	254	247	237	120
32708	254	239	32	6	45	32
32714	46	44	32	43	1	254
32720	239	237	120	254	251	32
32726	13	44	125	254	44	40
32732	4	254	43	32	24	45
32738	24	21	254	247	32	6
32744	37	32	14	36	32	11
32750	254	239	32	10	36	124
32756	254	23	32	1	37	34
32762	139	127	205	234	126	201

MONITOR



If you want to make the most of your BBC you will have to do battle with machine code. Richard Harris's monitor which tucks into just 2K of RAM yet includes a full disassembler should even up the odds.

WHY MIGHT you need a machine-code monitor? It could be that you want to investigate the machine-operating system, to see how programs and data are stored, or to test and change machine-code programs. Perhaps you wish to investigate screen layout, or even to recover corrupted Basic programs.

Whether you want to explore the workings of the BBC Micro or develop your own machine-code programs, this BBC monitor will fit most of the features of a good monitor into less than 2K, including a disassembler which — since it is written in machine code — runs a lot faster than some of the BBC disassemblers available commercially.

Six facilities

The monitor offers six facilities. It allows you to: display and change the contents of memory; display a block of memory; move a block of memory; run a section of machine code; disassemble code; and set the values of 6502 registers, run a subroutine and display the values of the registers on exit.

The published listing contains the assembly program which assembles the machine code for the monitor. It is not necessary, of course, to type in the comments and the preceding backslash.

Before running the program you must decide where you want the machine code to be assembled. Two of the most useful locations are below Page or above Himem. The version given here takes the first option and locates the monitor at 3600 — E10 in hex. To prevent it overwriting the assembly program, you need to move the start of the Basic program area. Once you have saved the program as listed, type in:

```
PAGE=&1500
NEW
LOAD "MONITOR"
RUN
```

You can now enter the monitor with

```
CALL &E10
```

If you prefer to store the monitor above Himem in Mode 7, set P% in line 30 to &6000 and type

```
HIMEM=&5FFF
LOAD "MONITOR"
RUN
CALL &6000
```

After the assembly program has been run the machine code can be saved as follows:

*SAVE "MON1" E10 1500 or *SAVE "MON1" 6000 6700

and loaded with

```
*LOAD "MON1"
```

Once in the monitor the screen should show

0000	FF 255	?
hex address	hex and decimal values	prompt

How to command

The monitor accepts the following commands: pressing the space bar increases the current address by one, and Return decreases it by one.

Entering two hex digits alters the value of the current address; and a full stop followed by four hexadecimal digits changes the current address. Entering the letter G displays an eight-by-eight block of data and addresses; entering R runs machine code from the current address; Z returns to Basic; and P enters the disassembler with the option of printer output. Press the space bar to continue disassembly and Return to leave it.

M moves a block of machine code. It expects three addresses in the form of four hex digits each — the Start and End address of the block to be moved, and the Start of the new block.

```
10REM MONITOR by R.W.Harris.
20FORM=1TO2
30P%=&E10                       :REM set base address of code
40data1=P%+955:data2=P%+1110:data3=P%+1265
50mess=P%+1420:XYmess=P%+1635:Pmess=P%+1670
60data4=P%+1675:sPtab=P%+1745    :REM set base addresses of data
70[OPT0
80                         \ of byte value,as used by screen,etc
90                         \ binary is actual byte value
100                        \ msb is bits 4-7  lsb is bits 0-3
110                        \ A,X,Y,P refer to 6502 registers
120.start LDA #0
130STA &00:STA &01:STA &02 \ initialize variables, set current
140LDA #100:STA &89        \ address (CA) to &0000
150LDA #10:STA &8A
160LDA #12
170JSR &FFEE               \ clear screen
180.ff JSR newlin          \ reentry for most routines,CR,LF
190.v8 JSR totalPrint      \ Print CA and value in hex and decimal
200.a JSR &FFE0            \ 9et ASCII value of key Press
210CMP #&2E
220BEQ addr                \ if "." change CA
230CMP #32
240BEQ next                \ if "sPace" increment CA
250CMP #13
260BEQ back                \ if "return" decrement CA
270CMP #&5A
280BNE l
290RTS                     \ if "Z" return to BASIC
300.l CMP #&47
310BNE m
320JMP block               \ if "G" disPlay block of hex values
330.m CMP #&52
340BNE n
350JMP (&0080)             \ if "R" run machine code from CA
360.n CMP#&4D
370BNE q1
380JMP move                \ if "M" move block of data to new address
390.q1 CMP #&50
400BNE q2
410JMP diss                \ if "P" 9oto dissassembler
420.q2 CMP #&53
430BNE o
440JMP subr                \ if "S" 9oto subroutine set-uP
450.o JSR check            \ if none of above,check hex key Press
460CPX #0:BEQ a            \ if not 9et new key Press
470JSR uPPer               \ if hex convert to msb
480JSR 9et                 \ 9et second hex key Press
490JSR lower               \ convert to lsb, combine with msb in A
500LDY #0
510STA (&80),Y             \ change value in CA
520JMP v8                  \ to reentry
530.addr                   \ routine to change CA
540LDY #2
550.aa JSR keysin          \ 9et and disPlay 2 key Presses for high
560STA &007F,Y             \ byte,and 2 for low and store as CA
570DEY
580BNE aa
590BEQ ff
600.next                   \ routine to increment CA by 1
610INC &80
620BNE ff
630INC &81                 \ inc. high byte when low &FF ^ &00
640JMP ff
650DEC &80
660LDA &80
670CMP #&FF
680BNE ff
```

BBC



After the first two addresses have been entered, the monitor prints a greater-than symbol as a prompt character. Entering S allows a subroutine, starting at the current address, to be tested — so long as it ends in RTS. It requires the A,X and Y registers to be set and provides the option of setting the

(continued on page 94)

```
690DEC &81                     \ dec. high byte when low &00 ^ &FF
700JMP ff
710.get                        \ gets hex key press
720JSR &FFE0
730JSR check                   \ ? hex
740CPX #0
750BEQ get                     \ if not hex get another
760RTS                         \ if hex return, value in A
770.upper                      \ with "lower" converts hex to binary
780CMP #&3A
790BCC cc
800SBC #7                      \ subtract 7 if &A-&F
810.cc SEC:SBC #&30            \ subtract &30 0-9 and &A-&F
820ASL A:ASL A:ASL A:ASL A \ rotate to msb
830STA &82                     \ and save
840RTS
850.lower
860CMP #&3A
870BCC bb
880SBC #7
890.bb SEC:SBC #&30            \ convert hex to lsb
900CLC:ADC &82                 \ add to msb, return with value in A .
910RTS
920.block                      \ display 8x8 block of hex
930LDA #8
940STA &82
950LDY #0
960.cd LDX #8
970STX &83
980JSR newlin
990JSR addrpr                  \ with address at start of each line
1000.bc LDA (&80),Y
1010JSR print
1020LDY #2
```

```
1030JSR space
1040INC &80                    \ inc. CA
1050BNE ab
1060INC &81
1070.ab DEC &83
1080BNE bc
1090DEC &82
1100BNE cd
1110JMP ff
1120.move                      \ routine to move block of data
1130LDY #6
1140JSR newlin
1150.gh JSR keysin             \ get 12 key presses, store as start and
1160STA &0082,Y                \ end addresses of block, and start of
1170DEY                        \ new block
1180BEQ de
1190CPY #4
1200BNE ef
1210LDA #&2C
1220JSR &FFEE                  \ prompt with ","
1230.ef CPY #2
1240BNE gh
1250LDA #&3E
1260JSR &FFEE                  \ prompt with ">"
1270JMP gh                     \ XXXX,YYYY>ZZZZ displayed
1280.de JSR escape             \ OK to proceed?
1290INC &85
1300BNE tw
1310INC &86                    \ inc. end of block, else last byte missed
1320.tw LDA &83:STA &80
1330LDA &84:STA &81            \ start of new block = new CA
1340DEX                        \ X= 1 on exit of JSR escape
1350.td LDA (&87,X)            \ do move
1360STA (&83,X)
1370INC &83
1380BNE km
1390INC &84
1400.km INC &87
1410BNE hi
1420INC &88
1430.hi LDA &87
1440CMP &85
1450BNE td
1460LDA &88
1470CMP &86
1480BNE td
1490JMP ff
1500.addrpr                    \ print CA in hex
1510LDA &81
1520JSR print
1530LDA &80
1540JSR print
1550LDY #2
1560JSR space:RTS              \ + 2 spaces
1570.check                     \ ? is value in A hex
1580LDX #0
1590CMP #&30
1600BCC e
1610CMP #&3A                   \ ie ASCII 0-9
1620BCC f
1630CMP #&41
1640BCC e
1650CMP #&47                   \ ie ASCII A-F
1660BCS e
1670.f LDX #1                  \ if yes, X= 1, if no, X= 0
1680.e RTS
1690.totalprint                \ prints -
1700LDA #13
1710JSR &FFEE                  \ CR
1720JSR addrpr                 \ CA
1730LDA (&80),Y
1740JSR print                  \ hex value in CA
1750LDY #4
1760JSR space                  \ 4 spaces
1770LDA (&80),Y
1780JSR dec                    \ decimal value in CA
1790LDY #4
1800JSR space
1810LDA #&3F
1820JSR &FFEE                  \ "?" prompt
1830RTS
1840.print                     \ print binary value in A as hex
1850TAX                        \ save value in X
1860AND #&F0                   \ mask msb
1870LSR A:LSR A:LSR A:LSR A\ rotate to lsb
1880JSR prout                  \ print
1890TXA                        \ restore value
1900AND #&F                    \ mask lsb
1910JSR prout                  \ print
1920RTS
1930.prout                     \ converts binary in A
1940CMP #&A
1950BCC z
1960CLC:ADC #7
1970.z ADC #&30                \ to hex
1980JSR &FFEE                  \ and prints
1990RTS
2000.space                     \ prints spaces
2010LDA #32
2020.x JSR &FFEE
2030DEY                        \ number in Y on entry
2040BNE x
2050RTS
2060.dec                       \ prints binary in A as decimal
2070LDX #2:STX &8C             \ flag for "0" or leading blank printed
2080.kx LDY #&30
2090.ky CMP &89,X              \ count number of 100's and 10's
2100BCC kz
2110INY
2120SBC &89,X                  \ 100 or 10 subtracted from A, count in Y
2130BCS ky
2140.kz CPY #&30
2150BNE kw
2160CPX &8C                    \ print "0" or blank
2170BNE kw                     \ if none
2180LDY #32
2190DEC &8C
2200.kw PHA                    \ else save remainder
2210TYA
2220JSR &FFEE                  \ and print count
```

(listing continued on page 93)

NEW SPECTRUM AND ZX81 SOFTWARE

"WINGED AVENGER"

Fast and furious. SPECTRUM version has SOUND and USER GRAPHICS. 7 LEVELS, 3 WAVES, MOTHER SHIP, HIGH SCORE, RE-FUELLING, RAPID FIRE, SMART BOMBS and LASER SHIELD. PCW "ONE OF THE BEST SINCLAIR GAMES YET". Only £4.50. All SPECTRUM + 16K ZX81.

"SPECTRUM SCRAMBLE"

MORE M/CODE ARCADE ACTION. "SO GOOD THE REVIEWERS DIDN'T REACH THE FINAL STAGE" (NOT BAD EH!!). NO LESS THAN 8 DIRECTIONAL KEYS for a SMOOTH MOVE. Full ARCADE features including, LASERS, BOMBS, INSTANT RESPONSE, CONTINUOUS SCORING, ROCKETS, SOUND, FUEL DUMPS, RED METEORS, DEFENDER CRAFT and HIGH SCORE. Beware CONDITION RED. With this one you MOVE, FIRE and BOMB AT THE SAME TIME. RELEASE PRICE of £4.95. 16K or 48K SPECTRUM.

"DO NOT PASS GO"
NOW THE 48K SPECTRUM VERSION IS READY

A COMPLETE SIMULATION of the BEST SELLING BOARD GAME, you know PARK LANE and all that. Up to SIX PLAYERS can compete with the MICRO doing all the WORK. Acts as DICE THROWER, BOARD, RENT COLLECTOR, UMPIRE, BANK, RULE BOOK, ACCOUNTANT and PROPERTY RECORD. SUPER GRAPHICS by Gary Kennedy (thanks mate). GAME SAVE with winner so far report. COMPLETE with INSTRUCTION BOOKLET. The ULTIMATE in FAMILY GAMES. Don't MONOPOLISE YOUR MICRO. AMAZE all your friends and family. (Can you see your GRANNY on a MICRO?) ONLY £6.95. 16K ZX81 VERSION ALSO £6.95.

"BASE INVADERS"

The ONLY ARCADE GAME EVERYBODY SHOULD HAVE. The SCREEN'S the same, THE INVADERS are the same, BUT you get a SHIELD and a CHOICE of THREE SPEEDS, (O.K., FAST or INCREDIBLE). GOOD SOUND, a HARD GAME, and GREAT GRAPHICS. COMPLETE your software collection for just £4.50. 16K and 48K SPECTRUM only.

"AUDIO SONICS"

WINNER of WIZZ KID 82. For the SPECTRUM. A.S. writes sound effects for your own programs. 26 PRE-SELECTED SOUND EFFECTS include TELEPHONE, POLICE SIREN, FROG, SPACE EFFECTS and OUTBOARD MOTOR. GO into MODIFY and you are presented with a display of SLIDER CONTROLS to adjust PITCH, RISE, FALL, BRISKNESS, DECEL, ACCELL, TONE, REPEAT RATE, STUTTER and DELAY. ADJUST the SLIDERS then INSTANTLY hear the SOUND CREATED. Call "THE SOUND ONE" and a program line will appear that is ready for insertion into your own programs. Hours of EXPLORATION. YOU WILL BE AMAZED what BEEP can DO. We are proud to offer this at £4.99. 16K or 48K SPECTRUM.

"SPECTRUM RENUMBER DELETE"

All M/CODE RENUMBERS ALL NOT PART. "YOU WON'T BUY A BETTER RENUMBER PROGRAM FOR THE SPECTRUM" JUST 600 BYTES. At £4.95. ALSO ZX81 VERSION.

"HIGH NOON"

When YOU'VE SAVED the GALAXY, SCRAMBLED or whatever else you do on your MICRO, what about a GUNFIGHT? Play the SPECTRUM or YOUR PALS. THREE LEVELS. FULL FEATURES, CACTI, COFFINS, WAGONS, RAPID or SINGLE SHOTS. SUPERB GRAPHICS. GOOD SOUND including DEATH MARCH. ESCAPISM on TAPE for JUST £4.50.

"DISPLAY"

Takes over when BIN and the DEMO tape left off. How would you like 273 different user defined GRAPHICS on a 16K SPECTRUM or a GRAND 336 for a 48K. All of these can be displayed on the screen at the SAME TIME. UDGs are stored as PAGES and any TWO PAGES may be exchanged in memory. FILES can be LOADED FROM or SAVED TO TAPE. LOAD into any page location. TURN a UDG ¼ turn, ½ turn, FLIP a SHAPE over, REVERSE a SHAPE, EXPAND ¼ of a CHARACTER into a full character, UP, DOWN, LEFT or RIGHT by one PIXEL. 5 SHAPE FILES are included on TAPE. INCLUDING a 64 CHARACTERS per LINE DISPLAY. COMPLETE with DEMO PROGRAM and INSTRUCTIONS. JUST RELEASED at £7.00. 48K or 16K SPECTRUM only.

"TRaceON"

BASED on a FILM (GUESS WHICH). TRaceON is a REAL TIME ADVENTURE for those of you who can't handle ARCADE GAMES. Your TASK is to COMPLETE a TRILOGY of GAMES successfully. A poor PERFORMANCE will result in a RESTART as may CHEATING. MASTER the DISKS and YOU get to ride a LIGHT BIKE and then RUN the CORRIDORS of DEATH to reach the MASTER CONTROL. REALLY GOOD FRUSTRATING FUN. 48K SPECTRUM £4.50 (16K coming soon.)

"MATCALC"

For BUSINESS and PROFESSIONAL use. Ideal for WHAT IF situations, CASH FLOW FOREC STS and analysing RELATED figures. 64 character display option. FORMULA may be MATHEMATICAL or LOGICAL. MENU of FUNCTIONS. SAVE and LOAD DATA to TAPE. FULL instructions included. LITERALLY HUNDREDS of USES. BOTH 48K and 16K SPECTRUM PROGRAMS on ONE TAPE. JUST £7.00. EXCELLENT VALUE.

"PROGRAMMERS DREAM"

A SPECTRUM TOOLKIT. Position independent and just 1450 BYTES. Facilities RENUMBER lines or blocks any increment or start. BLOCK OR LINE MOVE including a RENUMBER into place if required. BLOCK OR LINE ERASE. CHANGE SELECTED STRINGS (NAMES OR CONTENTS). DUMP variable names and values (usable in a loop). DISPLAY PROGRAM or PROGRAM plus VARIABLE SIZE. INSTANT and CLEAN. JUST £6.95 with explicit instructions.

WORK FORCE

140 WILSDEN AVENUE, LUTON, BEDS, ENGLAND
ALSO AVAILABLE AT BUFFER, MICROWARE AND SOFTWARE SUPERMARKET.
REM WORK FORCE WORKS HARDER.

C.J.E. Microcomputers

BBC SPECIALISTS

VAT included where applicable

QUALITY DISK DRIVES

Single drive 40 track single sided 1 × 100k	£200.00
Dual drive 40 track single sided 2 × 100k	£350.00
Dual drive 40 track double sided 2 × 200k	£546.25
Dual drive 80 track double sided 2 × 400k	£799.25

All drives are cased with own PSU for reliability, and include connecting cables and utilities disk. Delivery £4.00.

SOFTWARE FOR THE BBC MICRO

MISSILE CONTROL the first implementation on the BBC Micro of the popular arcade game. (32K)	£9.00
MAZE MAN an authentic version of the popular arcade game. (32K)	£6.00
BALLOONS a highly original game that soon becomes compulsive playing. (32K)	£6.00
DISSASSEMBLER the memory dump routine includes a scrolling back in memory facility. (16K)	£5.00

MISSILE CONTROL, MAZE MAN & BALLOONS use the Keyboard or Joysticks for control

30+ PROGRAMS FOR THE BBC MICROCOMPUTER

This Book contains program listings, with explanations & tips on using the BBC Micro
GAMES UTILITIES GRAPHICS & MUSIC
Most programs will run on Model's A & B
Edited by C.J. Evans, various Authors.
A pair of cassettes with all the programs is available.

BOOK £5.00
BOK & CASSETTE SET £9.00

LEADS

The BBC Micro comes without a cassette lead

7Pin Din to 2 × 3.5mm & 1 × 2.5mm minijacks	£4.00
7Pin Din to 5Pin Din & 2.5mm minijack	£4.00
7Pin Din to 7Pin Din	£4.00
7Pin Din PLUGS	Two for £0.65
6Pin Din PLUGS (for RGB socket)	Two for £0.65
5Pin Din PLUGS (360° for RS232)	Two for £0.65

RS423 TO RS423 (BBC Micro to BBC Micro)
Two metre cable £4.00 Four metre cable £5.00

TELEVISION/MONITOR LEADS
full range available

Phono plug to Co-ax with high quality cable 3 Metres	£3.00
BNC Plug to BNC Plug	£3.10
BNC Plug to Phono Plug (i.e. BBC Micro to Rediffusion TVRM)	£2.20

PRINTER CABLES

BBC to 36 way Centronics Type connector	£17.50
BBC to 25 way D Type (For use with RS232)	£9.50
BBC to 40 way edge connector (Centronics 739)	£20.00
TORCH to 36 way Centronics Type connector	£20.00

BLANK C30 COMPUTER CASSETTES

Ten for £4.50

15 Way D Type Plug with Cover £2.75
Computer graphics design pads 100 sheets £4.00

BBC UPGRADE KITS

RAM UPGRADE (100ns)	£23.00
KIT A Printer & I/O Port	£9.50
KIT B Analogue Port	£8.00
KIT C Serial I/O & RGB	£10.00
KIT D Expansion Bus/Tube	£7.50
Full Upgrade kit	£58.00

All components full specification

STAR DP8480 PRINTER
FROM £250.00 INC VAT

80 CPS : 80/96/132 COLS
BIDIRECTINAL LOGIC SEEKING
TRACTOR WITH FRICTION FEED

CENTRONICS	£217.39 + £32.61 VAT = £250.00
RS232	£235.00 + £35.25 VAT = £270.25

High Res Graphics option to allow BBC Screen dumps £15.00/£20.00
(24HR SECURICOR DELIVERY FOR PRINTERS £8.00)

VAT included where applicable

Send SAE for full Price List of our large range of accessories.
POSTAGE Add 50p per order or as stated

C.J.E. Microcomputers Dept (YC), 25 HENRY AVE, RUSTINGTON, W. SUSSEX BN16 2PA (09062) 6647

(listing continued from page 91)

```
2230PLA                         \ restore remainder
2240DEX
2250BNE kx
2260ADC #&30                    \ when units left convert to hex and print
2270JSR &FFEE
2280RTS
2290.message                    \ prints "message"
2300LDA mess-1,Y                \ Y holds starting point in "message data"
2310JSR &FFEE                   \ X holds length
2320DEY:DEX
2330BNE message
2340RTS
2350.YorN                       \ gets either "Y" (yes)
2360JSR &FFE0                   \ or "N" (no) key press
2370CMP #&59
2380BEQ q3
2390CMP #&4E
2400BNE YorN
2410LDX #0:RTS                  \ if no, X= 0, if yes X= 1
2420.q3 LDX #1:RTS
2430.newlin                     \ does 2 CR/LF
2440JSR &FFE7:JSR &FFE7:RTS
2450.keysin                     \ gets and displays 2 hex key presses
2460JSR get
2470JSR &FFEE
2480JSR upper
2490JSR get
2500JSR &FFEE
2510JSR lower                   \ converts to binary, in A on exit
2520RTS
2530.diss                       \ dissassembler -starts at CA
2540JSR newlin
2550LDY #181
2560LDX #13
2570JSR message                 \ ? output to printer
2580JSR YorN
2590BEQ q4
2600LDY #198
2610LDX #7                      \ if yes initialize printer
2620JSR message                 \ values given for Microline 80
2630.q4 LDA #&14                \ counter for lines of output
2640STA &83
2650.q5 JSR &FFE7
2660LDY #0
2670LDA (&80),Y                 \ get value in CA
2680LDX #&97
2690.q6 CMP data3,X             \ check if opcode
2700BEQ q7                      \ if is,branch
2710DEX
2720BNE q6                      \ if not -
2730JSR addrpr                  \ print CA
2740LDA (&80),Y
2750JSR print                   \ and contents
2760LDY #10
2770JSR space                   \ 10 spaces
2780LDY #191
2790LDX #10
2800JSR message                 \ NOT OPCODE message
2810.q9 INC &80
2820BNE q8
2830INC &81                     \ increment CA
2840.q8 DEC &83
2850BNE q5                      \ repeat till required number of lines
2860.w1 JSR &FFE0               \ get key press
2870CMP #&20
2880BEQ q4                      \ if "space" continue dissassembly
2890CMP #&0D
2900BNE w1                      \ if "return" exit to monitor
2910LDY #203
2920LDX #5
2930JSR message                 \ turning off printer
2940JMP ff
2950.q7 LDA data2,X             \ if value is opcode, X is pointer to
2960STA &84                     \ get pointer to "name" in message data
2970LDA data1,X                 \ get pointer to "address type" data
2980STA &85
2990TAX                         \ use this pointer
3000LDA data4,X                 \ to get number of bytes from
3010STA &86                     \ "address type" data
3020JSR addrpr                  \ print CA
3030LDA (&80),Y
3040JSR print                   \ and contents
3050LDX &86                     \ restore "number of bytes"
3060BEQ w2
3070.w3 INC &80
3080BNE w4
3090INC &81                     \ increment CA
3100.w4 LDA #32
3110JSR &FFEE                   \ print space
3120LDA (&80),Y
3130STA &87,X                   \ get and print and store value in new CA
3140STX &87
3150JSR print
3160LDX &87
3170DEX                         \ repeat for number of bytes
3180BNE w3
3190LDX &86
3200.w2 LDY sptab+1,X           \ get number of spaces from table
3210JSR space                   \ and print to keep output aligned
3220LDX #3
3230LDY &84
3240JSR message                 \ print opcode name
3250LDA #32
3260JSR &FFEE                   \ and space
3270LDY &85                     \ address type pointer
3280BEQ w5                      \ branch if "relative"
3290INY                         \ skip "no. of bytes" data
3300.w6 LDA data4,Y             \ get byte from "address type data"
3310BEQ w7
3320CMP #1
3330BEQ w7                      \ branch if 0 or 1
3340CMP #&FE
3350BNE w8                      \ if "FE" return for next opcode
3360LDX &85
3370BEQ w9
3380JMP q9
3390.w9 JMP q8                  \ avoiding inc. CA if was "relative"
3400.w7 TAX                     \ if data 0 or 1 then print
3410LDA &88,X                   \ high or low byte of address field
3420JSR print
3430INY
3440BNE w6
3450.w8 JSR &FFEE               \ if not 0,1,FE print ASCII equiv
3460INY
3470BNE w6                      \ next byte of "address type data"
3480.w5 LDA &88                 \ relative branching sums
3490TAX                         \ branch value in X and A
3500INC &80
3510BNE e1
3520INC &81                     \ increment CA
3530.e1 CLC
3540ADC &80                     \ add branch value to low byte CA
3550STA &88
3560LDY &81                     \ get high byte in Y
3570TXA                         \ restore branch value
3580BPL e2                      \ ? branch +ve or -ve
3590BCS e3
3600DEY
3610.e2 BCC e3
3620INY                         \ inc. or dec. Y if over page boundary
3630.e3 STY &89                 \ and store as new high byte
3640LDY #7                      \ return to print out as if
3650BNE w6                       absolute addressing
3660.a2 STX &85                 \ save X
3670JSR keysin                  \ get and print 2 key presses
3680LDX &85                     \ restore X
3690STA &85,X                   \ save binary value for Y,X,A
3700DEX
3710DEY
3720BNE a1
3730.subr                       \ subroutine set-up
3740JSR newlin
3750LDY #33
3760LDX #3
3770.a1 LDA XYmess-1,Y          \ get data for message
3780BEQ a2                      \ branch if 0 (3 times) for input
3790JSR &FFEE                   \ else print ASCII equiv
3800DEY
3810BNE a1
3820STY &84                     \ set flag to 0
3830JSR YorN                    \ "yes or no" to set status request
3840BEQ a3
3850JSR newlin
3860LDY #4
3870STY &84                     \ if yes reset flag
3880.a4 LDA Pmess-1,Y           \ print  P=
3890JSR &FFEE
3900DEY
3910BNE a4
3920JSR keysin                  \ get key press input
3930STA &89                     \ save binary
3940.a3 LDA #&4C
3950STA &7F                     \ put JMP opcode before CA
3960JSR escape                  \ OK to proceed?
3970JSR newlin
3980LDX &88
3990LDY &87                     \ set X,Y with stored values
4000LDA &86
4010PHA                         \ save value for A
4020LDA &84
4030BEQ a5                      \ if flag set
4040LDA &89                     \ get value for P
4050PHA
4060PLP                         \ set P via stack
4070.a5 PLA                     \ set A without affecting status P
4080JSR &007F                   \ do subroutine at CA
4090STX &88
4100STY &87
4110STA &86
4120PHP
4130PLA
4140STA &89                     \ save X,Y,A,P on return
4150LDY #33
4160LDX #3
4170.a6 LDA XYmess-1,Y          \ print message -branch if data = 0
4180BEQ a7
4190JSR &FFEE
4200DEY
4210CPY #15
4220BNE a6
4230LDY #3
4240.a8 LDA Pmess-1,Y             print "P=" message
4250JSR &FFEE
4260DEY
4270BNE a8
4280LDA &89
4290JSR print                   \ print hex of P
4300JMP ff                      \ return to monitor
4310.a7 LDA &85,X
4320STX &85
4330JSR print                   \ get and print X,Y,A in turn
4340LDX &85
4350DEX
4360DEY
4370BNE a6
4380.escape                     \ OK to proceed routine
4390JSR newlin
4400LDY #210:LDX #7
4410JSR message                 \ print message
4420JSR YorN                    \ get yes or no response
4430BNE v4                      \ if no return to monitor
4440PLA:PLA                     \ correcting stack for 1 subroutine
4450JMP ff
4460.v4 RTS                     \ if yes, proceed
4470]:NEXT M
4480                            REM
4490                            REM DATA STATEMENTS
4500                            REM data4= "address type" data
                                    data1= pointer to data4
4510                            REM data2= pointer to message data
4520                            REM data3= opcode search table
4530$Pmess=" =P "
4540
4550$XYmess="?N/Y sutatS teS  "+CHR$(0)+" =A  "+CHR$(0)+" =Y
    "+CHR$(0)+" =X"
4560
4570MESS$="DNACDALSAKRBLPBIMBQEBENBCVBSVBCCBSCBTIBYPCXPCPMCDLCILCC
    LCVLCROEYEDXEDCEDYNICNIXNIPMJRSJADLXDLYDLRSLPONAROAHPALPPHPPLP
    RORLORSTRITRCBS"
4580MESS$=MESS$+"XTSYTSATSCESIESDESXATAXTYATAYTXSTSXT TN/Y RETNIRP
    EDOCPO TON"
4590FORJ=1TO12:READS
```

(listing continued on next page)

(continued from page 91)

status register. On return from the subroutine it displays the contents of the registers. This is very useful in exploring *FX and other operating system calls.

The program listing is well annotated which should make it relatively easy to follow for those who want to understand exactly how it functions. One improvement they could try is to insert a routine into the disassembler to print out the ASCII characters for each bytes.

To put the monitor through its paces, you might like to try the following procedures. Enter the monitor with Call &E10 and then change the current address to &E10 by pressing the full stop key and typing 0E10.

Viewing versions

Remember that the monitor only accepts four-figure hexadecimal entries. If you now press P you will see the same disassembled version of the monitor that you keyed in earlier.

Press M and then enter 0E10, 1500 and 4000. This will copy the monitor to &4000 and if you press R it will call itself.

Finally you could try the facility for testing a subroutine by calling OSASCI. This is the operating system routine which writes a character from the Accumulator to the screen.

First change the current address to &FFE3 and press S. Set the X and Y registers to zero and the A register to 72, the ASCII code in hex for lower-case R. When run OSASCI will print a lower-case letter R to the screen in front of a display of the contents of the X register.

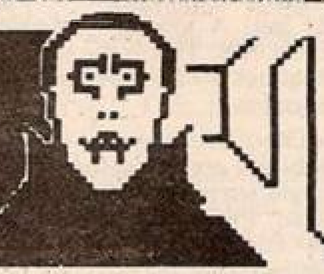
(listing continued from previous page)

```
4600MESS$=MESS$+CHR$(S):NEXT
4610DATA2,30,1,66,1,27,1,65,1,27,1,3
4620MESS$=MESS$+"?N/Y KO"
4630$mess=MESS$
4640
4650FORJ%=1TO3:READS%
4660$ftab?J%=S%:NEXT
4670DATA10,7,4
4680
4690FORJ%=0TO60:READS%
4700data4?J%=S%:NEXT
4710DATA1,1,&23,&26,0,&FE,2,&26,0,1,&FE,2,&26,0,1,&2C,&58,&FE,2,&26,0,1,&2C,&59
,&FE,1,&26,0,&FE,1,&26,0,&2C,&58
4720DATA&FE,1,&26,0,&2C,&59,&FE,1,&28,&26,0,&29,&2C,&59,&FE,1,&28,&26,0,&2C,&58
,&29,&FE,2,&28,&26,0,1,&29,&FE,0,&41,&FE,0,&FE
4730
4740FORJ%=1TO151:READS%
4750data1?J%=S%:NEXT
4760DATA67,49,25,25,67,1,64,6,6,0,41,29,29,67,18,11,11,6,49,25,25,25,67,1,64,6,
6,6,0,41,29,29,67,18,11,11
4770DATA67,49,25,25,67,1,64,6,6,6,0,41,29,29,67,18,11,11,67,49,25,25,67,1,64,57
,6,6,0,41,29,29,67,18,11,11,49,25,25,25,67,67,6,6,6,0,41,29,29,35,67,18,67,11
4780DATA1,49,1,25,25,25,67,1,67,6,6,6,0,41,29,29,35,67,18,67,11,11,18,1,49,25,2
5,25,67,1,67,6,6,6,0,41,29,29,67,18,11,11,1,49,25,25,25,67,1,67,6,6,6,0,41,29,29
,67,18,11,11
4790
4800FORJ%=1TO151:READS%
4810data2?J%=S%:NEXT
4820DATA12,105,105,9,114,105,9,105,9,15,105,105,9,57,105,105,9,87,3,39,3,123,11
7,3,123,39,3,123,18,3,3,123,144,3,3
4830DATA123,129,63,63,99,108,63,99,84,63,99,27,63,63,99,54,63,63,99,126,6,6,120
,111,6,120,84,6,120,30,6,6,120,147,6,6,120
4840DATA141,138,141,135,66,156,138,141,135,33,141,138,141,135,162,141,168,141,9
6,90,93,96,90,93,159,90,153,96,90,93,36,90,96,90,93,60,90,165,96,90,93
4850DATA42,48,42,48,72,75,48,69,42,48,72,24,48,48,72,51,48,48,72,45,132,45,132,
78,81,132,102,45,132,78,21,132,132,78,150,132,132,78
4860
4870FORJ%=1TO151:READS%
4880data3?J%=S%:NEXT
4890DATA0,1,5,6,8,9,&A,&D,&E,&10,&11,&15,&16,&18,&19,&1D,&1E,&20,&21,&24,&25,&2
6,&28,&29,&2A,&2C,&2D,&2E,&30,&31,&35,&36,&38,&39,&3D,&3E
4900DATA&40,&41,&45,&46,&48,&49,&4A,&4C,&4D,&4E,&50,&51,&55,&56,&58,&59,&5D,&5E
,&60,&61,&65,&66,&68,&69,&6A,&6C,&6D,&6E,&70,&71,&75,&76,&78,&79,&7D,&7E
4910DATA&81,&84,&85,&86,&88,&8A,&8C,&8D,&8E,&90,&91,&94,&95,&96,&98,&99,&9A,&9D
,&A0,&A1,&A2,&A4,&A5,&A6,&A8,&A9,&AA,&AC,&AD,&AE
4920DATA&B0,&B1,&B4,&B5,&B6,&B8,&B9,&BA,&BC,&BD,&BE,&C0,&C1,&C4,&C5,&C6,&C8,&C9
,&CA,&CC,&CD,&CE,&D0,&D1,&D5,&D6,&D8,&D9,&DD,&DE
4930DATA&E0,&E1,&E4,&E5,&E6,&E8,&E9,&EA,&EC,&ED,&EE,&F0,&F1,&F5,&F6,&F8,&F9,&FD
,&FE
```



ZX81 & 16K

THE TOMB OF DRACULA!



3D HORROR ADVENTURE GAME!

Occupying over 13½K of memory, a superb 3D graphics adventure game for the ZX81 with 16K RAM, **for only £3.95! Enter** Dracula's tomb at 30 minutes to sunset ... **wander** through the tomb's pre-mapped 300 vaults in search of the fabled Vampire's Treasure ... **pick up** valuable silver stakes and use them to defend yourself against the lurking horrors ... ghouls, zombies, pits of primaeval slime ... **See** them all on the ZX81's plan of the tomb ... when it will let you! **Take** a chance on a Mystery Vault ... if your dare! And all the time the minutes are ticking by to sunset ... when **Dracula** rises from his coffin and comes after **you**! Each of the infinite levels of the tomb has its own 300 vaults ... go as deep as you like, the Prince of Darkness will seek you out in his blood-lust! **WARNING:** people of an exceptionally nervous disposition should play this game only during the hours of daylight! Special facility enables a game in progress to be saved on tape so you can continue it whenever you choose.

Price of only **£3.95** includes ready-to-load cassette with library case and inlay, full instructions, postage and packing. Order today! Money refunded if not delighted! Send cash, P.O. or cheque to:

STOP PRESS
Colour, Sound version now available for 48K Spectrum **£4.95** inc. P&P.

MOVIEDROME VIDEO (DEPT. YC8)
19 Leighton Avenue, Pinner, HA5 3BW.

SINCLAIR OWNERS READ THIS FROM OCP

You've probably heard about MACHINE CODED PROGRAMS and thought "so what! How can they help me?"

Well now you can find out and taste the very real difference by purchasing our latest MACHINE CODED application program. This emulates features of the most modern professional computers (12 years writing machine coded programs for IBM, ICL, UNIVAC and Sinclair means we know what we're talking about).

Just read the specification and you'll see what we mean.

ADDRESS MANAGER.....

Works on the 16K and 48K Spectrum, in 48K it will store, file, select and retrieve over 400 full addresses (over 1500 individual names); Dynamic Memory Management and compression techniques makes all this possible and there's a lot more:

- **FULL SCREEN INPUT and EDITING** — see it as a page as it happens with insert, delete and TAB Commands.
- **MULTIPLE INDEXING** — 3 way user-defined index enables you to define, catalogue, select and print entries as needed, (essential for the more sophisticated applications.)
- **INSTANT RESPONSE** — yes, this program is very very fast.
- **SUPER FRIENDLY** — crash-proof, extremely easy to use and efficient in a way that BASIC can never be.

MANY USES

- **AT HOME** — (storing addresses, printing out Xmas Card lists etc.)
- **AT WORK** — for mail-order work, internal telephone directory, sorting customers into types, areas, size . . . you choose.
- **CLUBS** — print-out members list, sort different categories etc.

This program contains over 3000 MACHINE CODE instructions, yet uses little valuable memory space . . . a very powerful recommendation.

OR IF YOU WANT TO WRITE YOUR OWN MACHINE CODE PROGRAM

MACHINE CODE TEST TOOL

The ultimate professional tutor and de-bug program, we wrote this to help us write our own programs.

- **TEST** and display machine code instructions as they're written.
- **IDEAL** for both the novice and the expert.
- **FULLY** documented with a 32 page tutorial
- **HEX:DECIMAL** conversion as standard.
- **CHARACTER GENERATOR** — of unbelievable quality!!! supplied free with the Spectrum version.

Available for the 16K ZX81 and 16/48K Spectrum. If you're looking to write machine code this is THE program, we know we use it ourselves.

MACHINE CODE..IT MAKES ALL THE DIFFERENCE.....

Post order to: Oxford Computer Publishing Ltd., P.O. Box 99, Oxford.
Please rush me: ADDRESS MANAGER at £8.95 each. ☐ Spectrum only.
MACHINE CODE TEST TOOL at £9.95 each.
Tick box for edition required: ☐ ZX81 ☐ Spectrum
Send cheque, postal order or ACCESS No. to above address. Or telephone order with ACCESS No. to (0735) 888866 (Ansaphone available) YC3

NAME: . . . .
ADDRESS: . . . .
. . . . POSTCODE: . . . .
ACCESS Card No.: . . . .

CAMBRIDGE LEARNING
SELF-INSTRUCTION COURSES



GSC SUPERKIT £19.90

Learn the wonders of digital electronics!

This practical kit for beginners comes complete with an instruction manual, components, and EXP300 breadboard to teach you all the basics of digital electronics. The course needs no soldering iron; the only extra you need to buy is a 4½V battery.

Using the same board you can construct literally millions of different circuits.

The course teaches boolean logic, gating, R-S and J-K flipflops, shift registers, ripple counters, and half-adders.

It is supported by our theory courses

DIGITAL COMPUTER LOGIC & ELECTRONICS £6.00

which covers: basic computer logic; logical circuit elements; the design of circuits to carry out logical functions; flipflops and registers; and

DIGITAL COMPUTER DESIGN £8.50

Our latest, most up-to-date course on the design of digital computers, both from their individual logic elements and from integrated circuits. You are first shown the way in which simple logic circuits operate and then, through a series of exercises, arrive at a design for a working machine.

SPECIAL OFFER! All orders received before 25th December will be sent by 1st Class post at no extra charge.

GUARANTEE No risk to you. If you are not completely satisfied, your money will be refunded upon return of the item in good condition within 28 days of receipt.

CAMBRIDGE LEARNING LIMITED, UNIT 82 RIVERMILL SITE, FREEPOST, ST IVES, CAMBS, PE17 4BR, ENGLAND.
TELEPHONE: ST IVES (0480) 67446. VAT No 313026022

All prices include worldwide postage (airmail is extra - please ask for prepayment invoice). Giro A/c No 2789159. Please allow 28 days for delivery in UK.

......SUPERKIT(S) @ £19.90
......DIGITAL COMPUTER DESIGN(S) @ £8.50
......DIGITAL COMPUTER LOGIC AND ELECTRONICS @ £6.00

I enclose a *cheque/PO payable to Cambridge Learning Ltd for £........ (*delete where applicable)

Please charge my:

*Access / American Express / Barclaycard / Diners Club Eurocard / Visa / Mastercharge / Trustcard

Expiry Date............ Credit Card No ....

Signature..

Telephone orders from card holders accepted on 0480 67446

Overseas customers (including Eire) should send a bank draft in sterling drawn on a London bank, or quote credit card number.

Name..

Address..

.... GSCUnit81

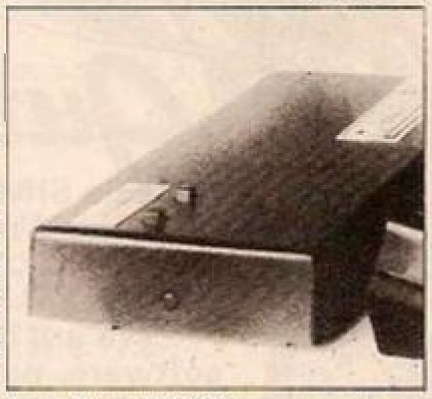
....

Cambridge Learning Limited, UNIT 82 Rivermill Site, FREEPOST, St Ives, Huntingdon, Cambs, PE17 4BR, England. (Registered in England No 1328762). YC3

CAMEL PRODUCTS

MEMIC-81.2 Faster than a Floppy. Easier than an EPROM. A 4K CMOS memory and Lithium battery unit. Saves programmes upto 10 years without external power. Plug it into the ZX81 and flick a switch and your program is ready for retrieval. A simple PRINT USR . . . entry loads your program into RAM. Resides in 8-12K but can be moved to 12-16K. Comprehensive notes + examples. **£29.95**

CRAMIC 81.2
Banish the Whir, Click and Try again of ZX81 Systems



16K CMOS RAM and Lithium battery in cabled ABS case, with expansion adaptor. Powers off the ZX81 when running. Resides in 16-32K. Can be used like an ordinary 16K but can also retain program upto 10 years. Ingenious hardware/software allows swopping of RAMs from program **£79.95**

ROM-81
Provides two 24 pin sockets for up to 8K of EPROM memory in the 8-16K area. Eproms are permanent memory which require programmers (see below) to write to them. Can use 2516/32 or 2716/32 **£14.95**

PIO-81
An 8+8 line parallel Input/Output card which lets the ZX81 communicate with external systems. Rugged TTL chips used. Connections on two 8 pin sockets. **£13.00**

DREAM-81 **A 64K with extras**
Full 16K Rampack with link options to disable 0-8-16K. Plus a 28 pin EPROM socket for 2716/2721/2764 and even the latest 27128 from Intel. Fast/slow Eprom option. Professionally built and tested. In an ABS case with an LED indicator. **£69.95**

NEW CAMEL PACK NEW
Finally, from a prestigious consultancy . . . A compactly built & tested 16K RAM for the ZX81. But WOW! Look at the price **£17.35**

NEW PROMER-81 NEW
At last! A low cost reliable programmer for 2516/32, 2716/32 EPROMS. This is the solution to using EPROMs instead of tape. Requires 4×PP3 batteries for a regulated 25 volts. Remarkably priced at **£19.95**

NEW BLOPROM-81 NEW
A highly sophisticated Eprom programmer for the 25XX, 27XX single supply families. Yes, even the 27128 from Intel. Check, Read, Program + Verify all or part of Eprom.
So immensely user friendly you'll hardly need the manual. Designed for the beginner but includes a single key entry route for the professional. Supplied as firmware, the m/c driver routine alone is worth more than the price of BLOPROM-81. No Personality Cards or other additions, just a ZX81. Several inbuilt safety features. On-board Vpp generation. 28 pin ZIF socket. Cabled connector and extender plug. ABS case. Note: Can provide up to 36 inputs or 40 outputs as an I/O **£79.95**

OTHER CAMEL PRODUCTS

MEMIC L Two kilobyte battery backed CMOS RAM unit for 2716/32 socket in any system **£26.05**

MEMIC L.2 four kB version of above **£35.95**

APPLE PAD 12" Rainbow cabled connector for Apple slots **£5.95**

PPS Cased, switched PSU. +5, +12, -12V, @ 3, 1, 0.25A **£44.95**



PSS Standard printer stands for OKI, Epson etc. 15"×12"×4.5" P+P £3.50 **£16.95**

PSL Large model 17"×14.5"×3.75" P+P £3.50 **£19.95**

POT Printer Output Tray for 11" fanfold paper P+P £3.50 **£16.95**

UK, VAT extra. No VAT on exports P+P UK, Free Europe + 5% — Overseas + 10%.
UK & Worldwide dealerships available.

Cambridge Microelectronics Ltd, One Milton Rd, Cambridge. CB4 1UY | Tel (0223) 314814

BBC ASSEMBLER

You can always tell a good assembler by its range of pseudo-op codes. Chris Melville looks at the BBC's resident assembler.

IN MORE ADVANCED assemblers we expect to see a wide range of pseudo-ops that could be used in our programs at assembly time. Figure 1 gives examples.

One should remember that all pseudo-ops are merely instructions to the assembler and in no way affect the machine code produced when it is eventually run.

The BBC assembler is part and parcel of the BBC Basic interpreter. As such it has access to the expression evaluator used in BBC Basic which means that almost any sensible expression that is valid in BBC Basic, providing it has a numerical result can be used inside an assembly language program. This in turn means that a lot of the funcations and variables available in Basic can be used, including your own as defined by Def Fn, as long as the results they produce are compatible with where they are used. For example, all of the following would assemble as the same thing:

```
LDA# SIN(RAD(90))* 30 + 5
LDA# 35
LDA# &23
LDA# ASC"#"
LDA# A%
```

has the ASCII value 35, A% has previously been assigned as 35 and ampersand indicates hexadecimal value in BBC Basic.

Any expression resulting in a floating point result will merely be truncated to the next lowest integer.

The Basic interpreter is suspended and the assembler brought in at any time by using the Basic statement [. Similarly the assembler returns control immediately to the interpreter on encountering]. Upon leaving the assembler, executing some Basic and then returning again to assembler, all assembly pointers such as the location pointer remain unchanged. This facility allows Basic and assembly language to be freely mixed and we will shortly see that mixing the odd Basic statement with the assembly language can provide a simple way of implementing all of the properties/pseudo-ops given in figure 1.

It is important to remember that when the assembler is called by [, all that happens is the conversion of the mnemonics into absolute binary machine code which is sequentially stored. The routines will not actually be executed until you call them using the Basic statements Call and Usr. This is shown simply in figure 2.

The Dim statement in BBC Basic will look for a continuous block of free memory, the amount depending on its argument, and return the address of the start of this block into a variable. To reserve a block of 200 bytes and assign the starting address to the variable start% use Dim start% 199.

This should be used, before entering the assembler, to bag some memory space for your assembled program unless you want it to be placed at some particular address onwards, which is fine if you are not bothered about it working across the Tube. So if your program is n bytes long — or less — then you need:

```
DIM space% n : P% = space%
```

This form of the Dim statement is not to be confused with Dim space%(n) which would declare an integer array called space%,n elements long.

The BBC assembler supports the use of labels in assembly language programs and these are handled as if they were Basic variables. Therefore they must start with a letter and not a reserved word. When labels are first defined they must be preceded with a full stop, and finish with RTS. When they are referred to, the full stop can be omitted, and needless to say they should not be multiply defined.

Since the assembler starts off at the beginning of an assembly language program and proceeds sequentially through it, problems arise when program segments include instructions referring to a label ahead before it is defined to the assembler.

This problem is overcome by making the assembler pass through the program twice, firstly taking note of all the labels and their values, which are stored in the Basic variable space in RAM and performing crude assembly of the mnemonics, translating the op-code and addressing mode, but not the address unless it is known, and substituting in any addresses it failed to find first time. If the assembly listing were examined in between these two passes, it would be seen that any instructions where forward reference occurred would have their address fields pointing to themselves. This two-pass process does not occur automatically on the BBC computer. It is necessary to force it to happen by enclosing the whole assembly language section in a For-To-Next loop which will be done twice. Of course this is unnecessary when there are no forward references in the program.

The choice of value of control variable in the loop is determined by what you want the assembler to output and how you want it to react to the presence of errors caused by forward referencing. This is explained now as we deal with the BBC assembler's only pseudo-op, OPT.

The usual state of affairs is that we require different assembler output on each pass of the assembler, and the most common occurs like this. On Pass 1, assembler errors are suppressed so that the process is not interrupted should forward references be present. There will be no assembly listing since the process will not be complete. On Pass 2, assembler errors are given — there are no unresolved forward references for this pass so we wish to be informed if any real errors are present.

We either see no listing at all or a full assembly listing of locations, hex code, mnemonics and labels.

We control this by using the "OPT n" pseudo-op straight after the opening square bracket. The possibilities are OPT 0 for error supression and no listing, OPT 1 for error supression and a listing, OPT 2 for error reporting and no listing OPT 3 for error reporting and a listing. This is incorporated into the For-Next loop of the last section.

```
For pass% = a To b step b-a
[    opt pass%
          ]
Next pass%
```

The "a" is the OPT value required in the first pass and b is the one for the second. Normally, a=0, b=2 or 3. The OPT pseudo-op obviously generates no machine code of its own.

The resident integer variable P% is the location pointer for the BBC assembler, that

(continued on next page)

Table 1. The 6502 instruction set.

ADC	add with carry	INY	inc. y
AND	logical and	JMP	jump
ASL	arthmetic shift left	JSR	call subroutine
BBC	branch if carry clear	LDA	load accumulator
BCS	branch if carry set	LDX	load x
BEQ	branch if equal	LDY	load y
BIT	test bit	LSR	logical shift right
BMI	branch if minus	NOP	no-operation
BNE	b. not equal	ORA	logical or
BPL	b. if plus	PHA	push accumulator
BRK	break	PHP	push processor status
BVC	b. overflow clear	PLA	pull into accumulator
BVS	b. b. overflow set	PLP	pull processor status
CLC	clear carry	ROL	rotate left
CLD	clear decimal mode	ROR	rotate right
CLI	clear interrupt disable	RTI	return from interrupt
CLV	clear overflow	RTS	return from subroutine
CMP	compare to accumulator	SBC	subtract with carry
		SEC	set carry
CPX	compare to x	SED	set decimal
CPY	compare to y	SEI	set interrupt disable
DEC	decrement memory	STA	store accumulator
DEX	decrement x	STX	store x
DEY	decrement y	STY	store y
EOR	exclusive or	TAX	transfer a to x
INC	increment memory	TAY	transfer a to y
INX	inc. x	TSX	transfer sp to x
TXA	transfer x to a		
TXS	transfer x to sp		
TYA	transfer y to acc		

The 6502 registers:
- accumulator (A) 8 bits
- x,y index registers (x,y) 8 bits
- processor status register nvbdizc 8 bits
- program counter 16 bits
- stack pointer 8 bits

6502 addressing modes

Name	Example
Immediate	LDX # 23
Zero page	LDY &32
Absolute	JMP &FFF3
Accumulator	ASL A
Relative	BEQ &23E3
Indirect	LDA (&2345)
Implied	PHA
Zero page x	STA 55,x
Absolute x	JMP &FF00,x
Pre-indexed direct	LDA (9,x)
Post indexed direct	LDA (34),y
Zero page with y index	STA 22,y

(continued from previous page)

is, it always holds the value of the address where the next encountered assembly instruction will be assembled to. Thus if we wanted a particular program to be assembled starting at location &A00 we would put, immediately after the For-To loop start; P%=&A00.

Alternatively, with the memory allocating system as previously described;

```
DIM space% PROGRAMSIZE
P% =space%
```

If one wants to leave a few spare bytes in memory in the middle of the machine code program, say for workspace or constant storage, then another alternative to the Dim method described earlier would be to leave the assembler and increment P% by the number of bytes you want. You could also use the byte indirection operators to initialise this memory, e.g., ?P%=. Then record the starting address of for example spare bytes, room=P% before you increment P%. Re-enter assembler and continue, using instructions such as LDA room to access your bytes. Issue I Basic/assembler does not allow the assembly of numerical constants straight into memory. To place constants in memory one should therefore use one of the methods already described. Issue II Basic/assembler does have the necessary pseudo-ops. These are EQUB, EQUW, EQUS and EQUD.

These all take a single argument and put its value into the assembly code.

```
.message EQUS "hello"
```

would store at ASCII code of "h" at message, "e" at message +1 and so on.

Unfortunately, there is no easy way that macros can be implemented with the assembler contained in Issue I Basic. However, the EQUS pseudo-op present in the Issue II Basic assembler can be used along with the Def Fn statement to implement macros of sorts.

A subroutine call to location &FFF4 in the operating system is known as an OSByte call. This call uses the processors X,Y,Acc registers to pass information to the operating system; Acc defines the operation to be carried out such as clear input buffer or alter flash rate or anything else that can be done as an FX call. X,Y contain the parameters. We could set up a macro which would take these three quantities as parameters, load them into the respective processor registers and call the OSByte routine. The macro itself would be defined in Basic as a function:

```
DEF FNOSBYTE (A,X,Y)
IF A>127 THEN [ OPT pass% : LDY # Y]
[OPT pass%: LDX # X : LDA# A: JSR &FFF4 :]
        (dummy null string result)
```

Only OSByte calls with numbers over 12 need a Y parameter. Then, when writing an assembly program if we wanted to do an OSByte call we would do the following:

```
EQUS FNOSBYTE (&87,5,5) reads the
  character at text (5,5)
EQUE FNOSBYTE (2,1,0) gets characters
  from RS423
```

Whenever the assembler encounters the above syntax the result will be the normal OSByte code sequence inserted into the assembly process, no string is actually inserted anywhere as the EQUS is fed with a null string by the function FNOSByte which also manages to do a little assembling before it gives this null result.

The ability to freely alternate between Basic and assembler makes conditional assembly a simple problem to solve. First leave Basic, use the control structures of Basic to examine the condition — use If-Then-Else, On-Goto/Gosub, and assemble the appropriate sections of code upon the result. If you want the assembler to choose between keyboard or joystick input in pseudo-Basic:

```
assemble ...... ] ; IF joystickconnected
THEN PROCassemblejoystickcode ELSE
PROCassemblekeycode [ :......assembler
```

The two given procedures do exactly what they say.

Repeated assembly is easy to achieve because of the easy interaction between the assembler and the Basic interpreter proper. There are two kinds of loops into which we can put the assembly language that we want copying.

Deterministic loops continue copying out the instructions until some condition is satisfied. We would use a repeat-until loop in the Basic part:

```
assemble] : REPEAT
   [ : (insert whatever is to be repeated here.
   it may involve the control variable, and
   there should be an OPT to control
   assembler output.) : ]
   There could be some Basic instructions
   here which would effect the loop control
   condition.
   UNTIL condition
   [: OPT pass% :......assemble.
```

Non-deterministic loops repeat the assembly mnemonics a fixed number of times. For this we would use a For-To loop:

```
...(assembler)] : FOR I% = startno. TO finishno.
   [ : OPT pass% : ......... assembly
   instructions, could involve the control
   variable I% if required. .......:]
   NEXT I%
   [ : OPT pass% :.........(back to assembler)
```

Diagram summarising assembly process

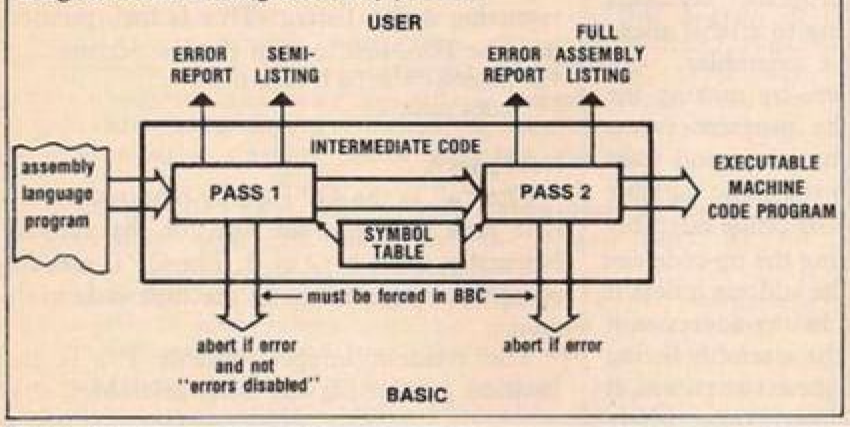


Figure 2. Calling routines.

```
10 PRINT "hello"
20 PRINT "now
   entering assembler"
30 DIM P% 100
40 enter assembler
50 .start PHA:TAX:
   CMP# &33 (more
   arbitrary assembly
   language)
100 RTS:
110 PRINT "back in
   Basic"
120 CALL start
```

Figure 1. Properties and pseudo-operating instructions.

■ The ability to reserve blocks of memory space for data, or even the program itself.

■ The allowing of symbolic labels and a multi-pass system, usually two occasionally three. This includes the automatic calculation of relative jumps.

■ The ability to reference the location pointer, a pointer to the next byte that will store machine code produced by the assembler, so that it is possible to use relative jumps in programs. For instance:

```
JMP . -5
```

allows you to jump back to the instruction five bytes further back in memory. The full point indicates the value of the location pointer. The location in memory where the next instruction is to be assembled can be specified by a statement such as:

```
=3200
```

■ User output — an assembly listing should be given, in both hex and mnemonics, errors should be reported and — preferably — there should be a symbol table output.

■ The assembler should be able to assemble numerical constants, or the result of a numerical expression, directly into memory, as well as mnemonics. For example:

```
label     32
label + 1 19-5
```

should result in the constant 32 stored in the location given by label, and 14 stored in label+1

■ It should also be able to evaluate simple numerical expressions elsewhere, so that

```
LDA# 7*2-2/2
```

would assemble as

```
LDA# 13
```

■ There should be a facility for the creation and use of macros. A macro is a set of instructions that does a particular job, similar to a subroutine in that respect, and given a specific name. Then, whenever the assembler comes across that name in a program it substitutes it with the set of instructions to which the name refers. Some assemblers allow macros to use parameter-passing also.

■ Conditional assembly — this facility allows the assembler to choose one of several program segments to assemble depending on the result of some specified test which is specified by the programmer and carried out at assembly time.

■ Repeated assembly — if a group of assembly language instructions are listed over and over in a program then it would be handy if it was necessary to write them only once and tell the assembler how many times to repeat them in a row. This is repeated assembly, for example:

```
REPEAT 10
             LDA somevalue
ENDREPEAT    STA somewhere
```

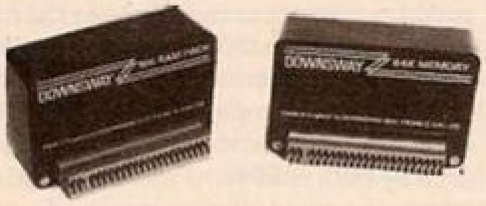
This might tell the assembler to write out the two instructions 10 times in a row and then assemble them. In some cases it might be possible for the values somevalue and somewhere to change each time the instruction pair is copied. Also, it may be possible for the number of copies to depend upon some condition rather than a fixed number, the difference between a For-To loop and a Repeat-Until loop in Basic illustrates this.

■ The assembler should recognise all 6502 mnemonics and addressing modes. ■

DOWNSWAY

ELECTRONICS (UK) LTD.

MEMORIES FOR THE ZX81



The Downsway 64K Memory* slots directly on to the computer, without needing an additional power supply, or adding any extra load to the internal 5v regulator. Trade in your old 16K RAM Pack (any make, any age, any condition) for £12.50 against a Downsway 64K Memory to bring the price down to only **£47.45** plus p & p. Without trade-in, it costs just **£59.95** plus p & p — still incredible value!

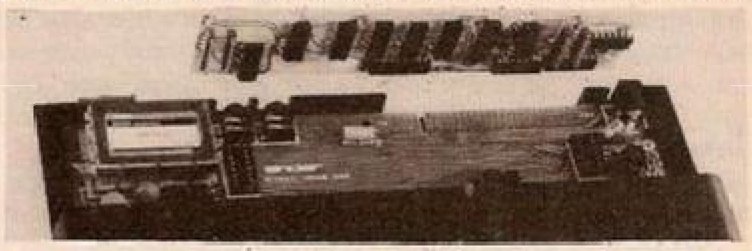
If you only want 16K of memory for your ZX81, the Downsway 16K RAM Pack offers the same benefits of high quality and low price at only **£24.95** plus p & p.

Both memories measure only 2½ x 1½ x 1in. and are supplied with a foam cushion strip to provide added mechanical stability.

* Reviewed in ZX Computing Aug/Sept 1982 and Popular Computing Weekly 22/7/82.

MORE MEMORY FOR YOUR ZX81 OR SPECTRUM!

NEW! 32K RAM FOR SPECTRUM



A full 48K of memory for the 16K Spectrum — simple D.I.Y. installation by just undoing 5 screws and plugging in!

For Issue One machines (with light grey keys) — a RAM board of advanced design, using "state-of-the-art" technology — only **£42.50** plus p & p.

For Issue Two machines (with dark grey keys) — a simple plug-in kit of I.C.s which fit straight in to the sockets already provided: only **£32.50** plus p & p.

Both come with fully detailed, illustrated instructions.

Naturally Downsway add-on memories are fully tested and guaranteed, but should you be dissatisfied for any reason, just return the memory within 14 days for a full refund (and your old 16K RAM pack, where appropriate).

Please allow up to 28 days for delivery.

DOWNSWAY ELECTRONICS (UK) LTD. DEPT. M, DOWNSWAY HOUSE, EPSOM ROAD, ASHTEAD, SURREY.

Please send me:

Qty.	Item	Price	Total
	32K RAM Board (Issue 1 Spectrum)	£42.50	
	32K RAM Kit (Issue 2 Spectrum)	£32.50	
	64K Memory for ZX81 at trade-in price	£47.45	
	64K at normal price	£59.95	
	16K RAM	£24.95	
	Post & packing		£2.00
	Total		£

My cheque/P.O./Money Order is enclosed

Please debit my Barclaycard No. ....

Name: ....

Address: ....

....

VISA



*SPECTRUM MONITOR
*SPECTRUM EDITOR/ ASSEMBLER
*ZX81 SCREEN KIT 1
*ZX81 ZX-MC *ZX81 REMLOAD

FAST MAIL ORDER-SEND TODAY!

SPECTRUM MONITOR. Machine Code Debug/Disassembler • Enter, Run, Debug machine code programs. • Compatible with Basic • Breakpoints and Registers Display • Disassembly to screen and/or ZX Printer • 16K and 48K versions on one cassette + 30 page manual. **£7.50**

SPECTRUM EDITOR/ASSEMBLER. A powerful and essential machine code programming aid. 16K & 48K on same cassette with full documentation. Major features include: EDITOR with Auto Line Numbering: 40 Column screen display, tabulated into fields for easy reading: 5 character Label Names: simple Line Editing and Cursor Control: SAVE/LOAD Text Buffer to cassette: output to ZX PRINTER.

TWO-PASS ASSEMBLER accepts all Z80 mnemonics (plus many unpublished mnemonics): Decimal or Hex numbers: simple arithmetic on operands: Assembler Directives — ORG, END, DEFB, DEFW, DEFS, DEFL, EQU, DEFM.

WE CANNOT FULLY DESCRIBE THIS IMPORTANT UTILITY HERE, AND ASK YOU TO SEND A S.A.E. FOR COMPLETE DETAILS OF THIS AND ALL OUR PROGRAMS. **£8.50**

ZX81 SCREEN KIT 1. More power to your screen in all your Basic programs BORDERS any size, anywhere on screen. SCROLL in all 4 directions. CLEAR and REVERSE PART OF SCREEN. FLASHING CURSOR anywhere on screen — simulates INPUT. DATA FILES SAVE AND LOAD Basic variables: Double Speed. 880 bytes machine code for INSTANT RESPONSE. Becomes part of Basic Program. **£5.70** 4K to 64K

ZX81 ZX-MC. Machine Code Debug/Monitor • ENTER, RUN, DEBUG machine code programs • SAVE, LOAD, VERIFY at double speed • BREAKPOINTS and REGISTERS DISPLAY • Self contained — cannot be used with Basic • Cassette plus 36 page manual. **£7.50** 4K to 64K

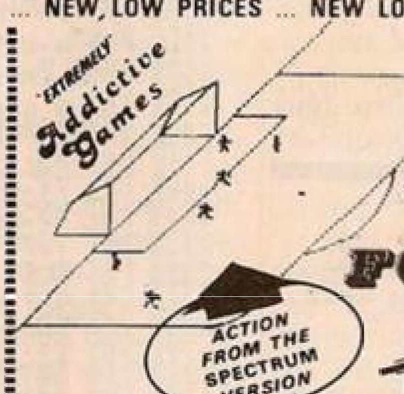
ZX81 REMLOAD. Machine Code Debug/Monitor • A version of ZX-MC without the Save/Load/Verify facility • Compatible with Basic • CREATE A REM LINE of any length • BREAKPOINTS and REGISTERS DISPLAY • Cassette plus 30 page manual. **£6.95** 16K to 64K

SEND S.A.E. NOW FOR DETAILS
6 Corkscrew Hill, West Wickham, Kent BR4 9BB.

Prices include VAT & P&P

PICTURESQUE
PICTURESQUE
PICTURESQUE
PICTURESQUE

...LOW PRICES ... NEW LOW PRICES ... NEW LOW PRICES ... NEW LOW PRICES ... NEW LOW PRICES ... NEW LOW PRICES ... NEW LOW PRICES ... NEW, LOW PRICES ... NEW LOW PRICES ... NEW LOW PRICES ...



NOW! for the SPECTRUM FOOTBALL MANAGER IN 3D

COLOUR GRAPHICS

FEATURES INCLUDE.......

★ 4 DIVISIONS ★ F.A. CUP ★ PROMOTION & RELEGATION ★ TRANSFER MARKET ★ TEAM SELECTION ★ SAVE GAME FACILITY ★ LEAGUE TABLE ★ AND MUCH MORE!

ALSO AVAILABLE AT BOOKSTORES & COMPUTER SHOPS INCLUDING BUFFER MICROSHOP, LONDON & MICROWARE, LEICESTER. 3D GRAPHICS ONLY INCLUDED IN SPECTRUM VERSION

NEW LOW PRICES

~~£7.95~~ ALL PRICES FULLY INCLUSIVE

£6.95 -SPECTRUM
£5.95 -ZX81

HARDWARE REQUIRED

Spectrum 48K RAM   ZX81 16K RAM

To Order send Cheque/P.O. payable to:
ADDICTIVE GAMES
at: Dept. Y.C. P.O. Box 278
CONNIBURROW.
MILTON KEYNES MK14 7NE
PLEASE STATE COMPUTER

We're tired of telling you how good our game is...... let our customers tell you

Dear Sir,

I received a copy of your Football Manager, Spectrum 48K game a couple of weeks ago and felt I must just write and congratulate you on such an "addictive game".

I started on the beginners skill level with Ipswich Town in the Fourth Division. After having played six seasons I am now into the first division having won the F.A. Cup whilst in the second division. All of which took about nine hours of being glued to the screen.

Since reaching the first division I have increased my skill level and am now sixth in the table after ten seasons and about 15 hours!

The reason I am suprised that I have played this game more than any other in my library over the last two weeks, is because I don't really like watching football on television. I don't even support a team. The structure of your game is such that anyone can play it.

P. A. HACKMAN,
BURY ST. EDMUNDS

ORIGINALS CAN BE SEEN ON REQUEST

ONCE UPON a time when most people still thought that a microprocessor was some fancy kitchen gadget, breakfast was continually disturbed by the rhythmic chant of children trying to learn their French vocabulary for school that morning. When we acquired a ZX-81 we therefore set about using this so that our 'snap, crackle and pop' would not be disturbed.

The very limited memory of the basic 1K unit was a severe problem, but with care 20 words — each 12 characters long, in each of two languages, could be stored for knowledge testing. Two separate programs needed to be used. The Word-loader program dimensions three arrays and requests 20 consecutive word inputs in each language. These are stored in arrays A and B.

When all words have been entered this program must be altered to the Word-testing program before Saving on to cassette by Goto200. Of course, the ZX-81 saves variables with the program but, whatever you do, you must not Run this program, as this will clear the arrays. When the program is reloaded it automatically starts, and when all words have been tested the program begins again.

It is essential that C$ is dimensioned — so that its length is fixed at 12 characters — the same as B$(N), as otherwise it will be impossible for it to be equal to B$(N).

Score is kept as X, which is incremented when line 150 is true. To conserve memory only the top two lines of the screen are used to display:

TEST WORD	SCORE
YOUR TRY	ANSWER

Pause is used instead of a For-Next timing loop and the program entirely fills 1K.

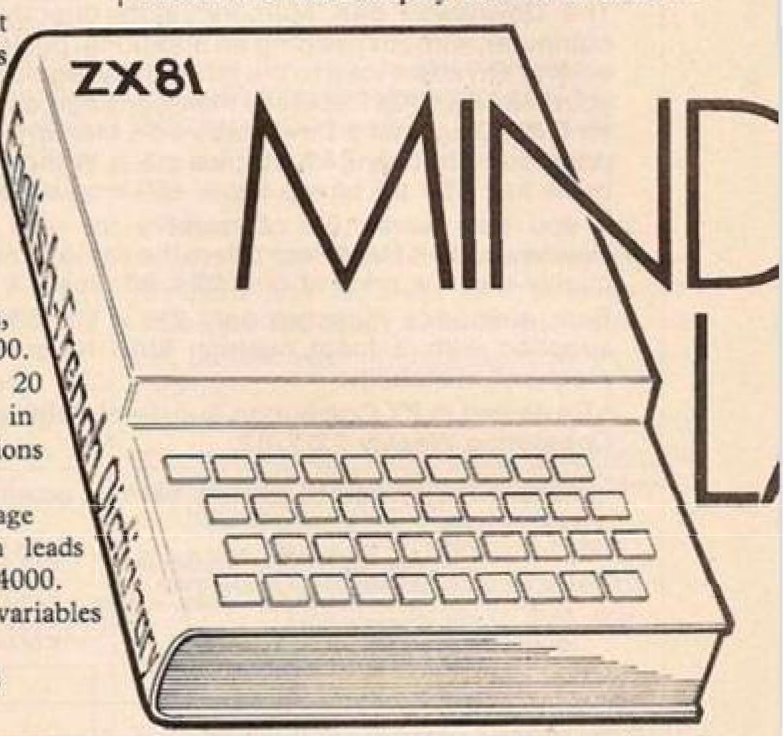
Only 20 words could be included in this initial program, but different versions could be made containing different words. For storage of more words more memory is essential — hence the development of the Vocab 16K program which not only stores 220 words or phrases, each 25 characters long, but also includes a range of useful options: adding words, testing yourself, learning and dictionary. One of the most perplexing problems was arranging for the facility to swap the two languages around, whilst ensuring that the arrays did not become garbled.

To initialise the program when it is first used, Run 8000 which Dims the arrays and sets up the other variables, before requesting the languages to be used. This was not included in the menu to avoid disastrous accidents to filled arrays. Do not forget you must never Run the program if you use Break to stop it. To save the program, plus variables, at any point Goto 9000.

The user-friendly menu at line 20 first prints the selected languages, in the order entered, and then the options available.

If you want to reverse the language order you simply input X, which leads to the language-swap subroutine at 4000. This swaps M$ and N$ via dummy variables K$ and L$. At the same time the language-swap status variable, T, is swapped between 0 and 1 so that the swap status is always indicated. If Add-words is selected the screen is cleared at line 3000 and the word select subroutine at line 6000 called. This asks where in the main arrays to start and end addition, prompting you with the current start and end numbers. To delete words simply overwrite them.

Lines 6010-6040 and 6080-6100 reject anything other than numbers. As the numbers often exceed nine this has to be done via string slicing, and the final strings must therefore be converted to simple variables by the Val function — 6050 and 6110. This subroutine is used by both Add-word and Test routines. On return the word display routine is called —



The 16K ZX-81 language program.

```
   5 REM VOCAB COPYRIGHT K + S E
RAIN 010682
   9 REM MENU
  10 CLS
  20 PRINT M$,N$,"VOCABULARY"
  30 PRINT AT 5,0;"TO TEST YOURS
ELF INPUT ""T""";AT 7,0;"TO CONS
ULT DICTIONARY INPUT ""D""";AT 9
,0;"TO ADD WORDS INPUT ""A""";AT
 11,0;"TO LEARN INPUT ""L"""
  40 PRINT AT 20,0;"TO REVERSE L
ANGUAGE ORDER";"INPUT ""X"""
  49 REM MENU SELECTION
  50 INPUT Q$
  60 IF Q$="T" THEN GOTO 1000
  70 IF Q$="D" THEN GOTO 2000
  80 IF Q$="A" THEN GOTO 3000
  90 IF Q$="L" THEN GOTO 7000
 100 IF Q$="X" THEN GOSUB 4000
 110 IF Q$="X" THEN GOTO 10
 120 GOTO 50
 999 REM TEST
1000 CLS
1010 PRINT "TEST"
1020 PRINT AT 5,0;"FOR RANDOM WO
RDS INPUT ""R""";AT 7,0;"FOR PAR
TICULAR WORDS INPUT ""P"""
1029 REM RANDOM OR PARTICULAR
1030 INPUT P$
1040 IF P$="P" THEN GOSUB 6000
1050 IF P$="P" THEN GOTO 5000
1060 IF P$="R" THEN GOTO 1100
1070 GOTO 1040
1100 PRINT AT 9,0;"HOW MANY WORD
S?"
1110 INPUT W$
1120 FOR N=1 TO LEN W$
1130 IF CODE W$(N)<28 OR CODE W$
(N)>37 THEN GOTO 1110
1140 NEXT N
1150 LET W=VAL W$
1160 PRINT AT 9,20;W
1169 REM RANDOM START
1170 LET H=INT (RND*Y)+1
1179 REM VALID START ELSE HALVE
1180 IF H+W>Y THEN LET H=H/2
1190 IF H+W>Y THEN GOTO 1180
1195 IF H<1 THEN LET H=1
1200 LET XA=H
1210 LET YA=H+W-1
1220 GOTO 5000
1999 REM DICTIONARY
2000 CLS
2010 PRINT M$,N$,"[illegible]";AT
 5,5;"INPUT UNKNOWN WORD";AT 20,
0;"[illegible]"
2020 INPUT D$
2030 IF D$(1)="X" THEN GOSUB 400
0
2040 IF D$(1)="X" THEN GOTO 2000
2050 IF D$(1)=" " THEN GOTO 10
2060 PRINT AT 7,1;D$
2065 FAST
2069 REM SEARCH ARRAY
2070 FOR N=X TO Y
2080 IF T=0 THEN GOSUB 4100
2090 IF D$=B$(N) THEN GOTO 2130
2095 IF T=0 THEN GOSUB 4100
2100 NEXT N
2109 REM NO MATCH
2110 PRINT AT 10,5;"[illegible]
[illegible]"
2120 GOTO 2140
2129 REM MATCH
2130 PRINT AT 10,1;A$(N)
2135 IF T=0 THEN GOSUB 4100
2140 SLOW
2145 FOR N=1 TO 50
2150 NEXT N
2170 GOTO 2000
3000 CLS
3010 GOSUB 6000
3020 GOSUB 5000
3030 IF T=0 THEN GOSUB 4100
3040 RETURN
3999 REM LANGUAGE SWAP
4000 LET K$=M$
4010 LET L$=N$
4020 LET M$=L$
4030 LET N$=K$
4040 LET T=F
4050 LET P=E
4060 LET F=P
4070 LET E=T
4080 RETURN
4099 REM ARRAY SWAP
4100 LET C$(1)=A$(N)
4110 LET E$=B$(N)
4120 LET A$(N)=E$
4130 LET B$(N)=C$(1)
4140 RETURN
4999 REM WORD DISPLAY
5000 FOR N=XA TO YA
5010 IF T=0 THEN GOSUB 4100
5020 CLS
5030 PRINT AT 5,5;M$
5039 REM TEST BRANCH 1
5040 IF Q$<>"A" THEN GOTO 5060
5050 INPUT B$(N)
5060 PRINT AT 7,1;B$(N);AT 10,5;
N$
5069 REM TEST BRANCH 2
5070 IF Q$<>"A" THEN GOTO 5130
5080 INPUT A$(N)
5090 PRINT AT 12,1;A$(N)
5100 FOR M=1 TO 50
5110 NEXT M
5120 LET Y=YA
5125 GOTO 5175
5130 INPUT C$(1)
5140 PRINT AT 12,1;C$(1);AT 14,1
;A$(N)
5150 FOR M=1 TO 50
5160 NEXT M
5169 REM CHECK MATCH
5170 IF C$(1)=A$(N) THEN LET Z=Z
+1
5175 IF T=0 THEN GOSUB 4100
5180 NEXT N
5190 IF Q$="A" THEN GOTO 10
5199 REM SCORE
5200 PRINT AT 20,5;"SCORE = ";Z
5210 FOR M=1 TO 70
5220 NEXT M
5230 LET Z=0
5240 GOTO 10
5999 REM WORD SELECT
6000 PRINT AT 9,0;"START WORD NU
MBER?";AT 11,0;"END WORD NUMBER?
";AT 15,0;"[illegible]
";Y
6010 INPUT X$
6020 FOR N=1 TO LEN X$
6030 IF CODE X$(N)<28 OR CODE X$
(N)>37 THEN GOTO 6010
6040 NEXT N
6050 LET XA=VAL X$
6060 PRINT AT 9,22;XA
6070 INPUT X$
6080 FOR N=1 TO LEN X$
6090 IF CODE X$(N)<28 OR CODE X$
(N)>37 THEN GOTO 6070
6100 NEXT N
6110 LET YA=VAL X$
6120 PRINT AT 11,22;YA
6130 RETURN
6999 REM LEARN
7000 CLS
7010 LET XX=0
7020 FOR N=X TO Y
7030 LET XX=XX+1
7040 PRINT A$(N),B$(N),,
7050 IF XX=7 THEN GOTO 7090
7060 NEXT N
7070 INPUT O$
7080 GOTO 10
7090 INPUT O$
7100 LET XX=0
7110 CLS
7120 NEXT N
7999 REM INITIALISE
8000 DIM A$(220,25)
8010 DIM B$(220,25)
8020 DIM C$(1,25)
8025 DIM D$(25)
8030 PRINT AT 5,0;"FIRST LANGUAG
E?"
8040 INPUT M$
8050 PRINT AT 7,5;M$
8060 PRINT AT 9,0;"SECOND LANGUA
GE?"
8070 INPUT N$
8080 PRINT AT 11,5;N$
8090 LET T=0
8100 LET F=1
8110 LET P=1
8120 LET E=0
8130 LET X=1
8140 LET Y=1
8150 LET Z=0
8999 GOTO 10
9000 SAVE "VOCAB 16K"
9010 GOTO 10
```

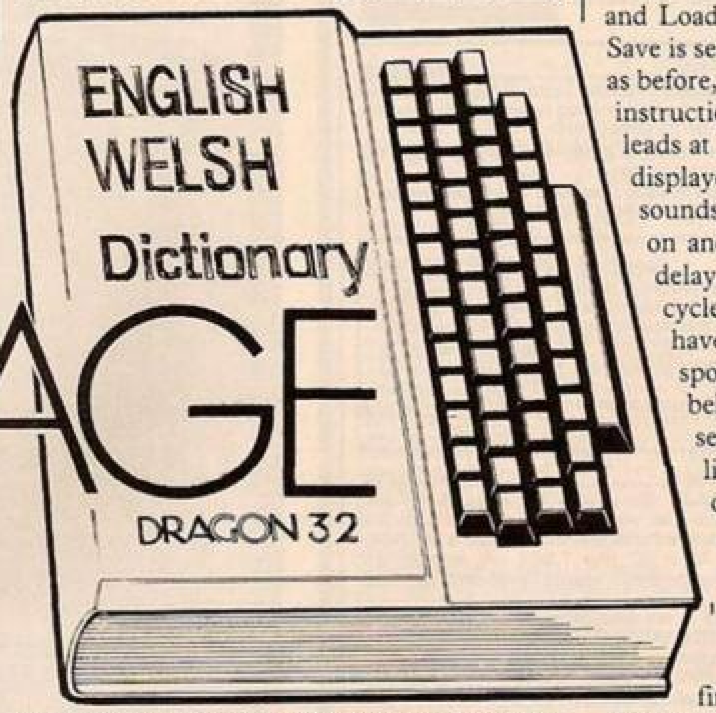
V1K WORD LOADER PROGRAM

```
  10 DIM A$(20,12)
  20 DIM B$(20,12)
  30 DIM C$(1,12)
 110 FOR N=1 TO 20
 120 CLS
 130 INPUT A$(N)
 140 PRINT A$(N)
 150 INPUT B$(N)
 160 PRINT B$(N)
 170 PAUSE 100
 180 NEXT N
```

V1K WORD TESTING PROGRAM

```
 100 LET X=0
 110 FOR N=1 TO 20
 120 CLS
 130 PRINT A$(N),
 140 INPUT C$(1)
 150 LET X=X+NOT C$(1)<>B$(N)
 160 PRINT C$(1),X;CHR$ 24;N,B$(N)
 170 PAUSE 100
 180 NEXT N
 190 GOTO 100
 200 SAVE "V1K"
 210 GOTO 100
```

YOUR LANGUAGE



Keith and Steven Brain's ZX-81 and Dragon routines help you and your micro become multilingual.

5000. This is also used by both Add and Test routines, but with different branches. It cycles through the arrays from the selected start to the selected end — 5000, after checking the status — T — of the languages M$ and N$ — this is done at line 5010.

If these have been swapped then the word-swap subroutine at 4100 is next called. This swaps A$(N) and B$(N) via dummy variables. The first language is printed and, if Add was selected — Q$="A" — an input — B$(N) — is requested and printed, followed by the second language, and a second input request — A$(N). After a delay — 5100 — the word end counter, Y, is reset to the new end-word number — 5120, and if the languages have been reversed from their original order, then A$(N) and B$(N) are swapped back — 5175. When all words have been added the program returns to the menu.

If Test is now selected the choice subroutine — 1000 — allows selection of particular or random words. If particular words are required, the appropriate Start and End number are selected as before — 6000. The random option asks the number of words required, W, and selects a random start position H at line 1170. If H+W is greater than the total number of words currently in the array, Y, then H is halved — 1180 — and this is repeated — 1190 — until H+W is less than Y, when the program passes to the word-display routine — 5000. Whether random or particular words are selected this subroutine operates as for adding words, except that the sequence is: Print first language, line 5030; Print A$(N); Input C$(1), Print C$(1), print A$(N), the correct answer, line 5140. If your try was correct the score — Z — is incremented — 5170 — and when all words have been tested your final score is displayed.

The Learn subroutine at line 7000 prints the first seven pairs of words and then waits for an input. If there were only seven words or less in the file then any input leads back to the menu. If there were more than seven words any input displays the next seven pairs of words.

The final option is the Dictionary, line 2000, which prints the languages and requests input of the unknown word. Languages can be swapped by X as before and Newline alone returns to the menu. When an unknown word is entered, it is compared with the contents of the appropriate array. If a match is found the matching word is printed, otherwise the "word not found" message comes up. This subroutine is run in Fast mode to speed it up but, if you prefer waiting a little longer to watching the screen flash then delete lines 2065 and 2140.

This 16K ZX-81 program is obviously more useful than the 1K version, and any additional memory available can be utilised simply by changing the Dim statements in lines 8000 and 8010.

When a Dragon 32 was purchased and conversion of the ZX-81 program was considered, it was soon apparent that the Dragon had a number of distinct advantages in this learning application. The first of these was the ability to store data files on cassette separate from the program, so that the relatively short master program could be used for any number of different data files containing different words or languages.

The second difference was in the Basic array-handling routines. Whereas in the ZX-81, array elements must be of fixed length, Microsoft supports variable length array elements. In practice, this means that memory is saved as space is not wasted on blanks completing unused array points. This allowed the program to be more flexible and the length of phrases to be up to 255 characters.

The third point was the ability to control a cassette recorder and TV sound with the Motor and Audio commands, making inclusion of a speech track possible. The fourth point was the high-resolution graphics which allowed display of non-standard characters such as accents.

Finally, multiple-statement lines make complex programming easier and sound and colour can be used to liven up the proceedings.

The same outline skeleton was used, but with certain additions. As the data is loaded separately, the program always initialises the arrays and other variables and requests the languages — line 11000. The menu, line 1030, is left via Inkey$, line 1050, rather than Input, and the ASC value of Inkey$ is used to sound a note to remind you of your choice. Where lower-case letters, which are inverse on-screen are used, unsightly gaps between words are avoided by using BL$, which is set to CHR$(128), instead of a space between words.

A new cassette Load-Save routine is included — Line 8000. Selection of Save — 8010 — requests File-name, Start and End positions. The cassette motor is turned on to allow you to position the data tape and when you are ready a data file is opened and the languages (M$, N$), swap status (T) and array contents saved. Selection of Load also requests filename, Start and End positions. These need not be the same as those used when these words were Saved, but can be offset so that words can be moved around the arrays. Languages — M$ and N$ — swap status, T, and words are then read in 8030.

The Audio routines — 9000 — allow Saving and Loading of both data and voice, 9030. If Save is selected a data file is opened and loaded as before, line 9060. When Saving is complete, instructions are given to alter the cassette leads at line 9080. Each selected word is now displayed — Line 9100 — and, when a tone sounds, the recorder is automatically turned on and you speak the word. After a short delay, the next word is displayed and the cycle continues until all selected words have been dealt with. In this way, a spoken-word file follows immediately behind the word data file. When Play is selected, the data file is read back — line 9120 — and speech playback only, or speech and display can then be chosen.

If the display and speech option is chosen, the first language and first word are displayed, and the recorder automatically plays the first spoken word through the TV speaker.

The program as described so far is excellent as long as neither of the languages uses accents, but even this difficulty can be solved if the characters are drawn on the hi-res screen instead of being printed — see *Your Computer*, February 1983.

This approach requires addition of appropriate character-drawing lines — 31-90 — and handling routines. The little-used upper case #, $, %, and & have been replaced by `, ´, ^ and ç, for French text but any keys can be modified in this way. We have stuck labels on to the front edge of these keys to show their new functions.

Line 20 checks that a character is valid and, if so, line 30 selects the appropriate Draw subroutine. Two different types of the hi-res display are needed — 100 — according to whether an existing string is to be read or an Input is to be made. These are indicated as MD=1 and MD=2.

If MD=2, line 300, a string — R$ — is simply sliced and each character drawn in turn. If an Input is required, life is more difficult. Only Inkey$ can be used without losing the hi-res display. If the Inkey$ character is Enter and any character has already been loaded, this is read as the same as a normal Enter and Input mode is left. If Inkey$ is not backspace — left cursor — the equivalent character is displayed, and then added on to the end of TM$ — a temporary storage string.

If backspace is used, the previous character is erased from the screen. Once the handling

(continued on page 103)

(continued from page 101)

routines have been set up, those program lines which are to display accented words must be modified.

The modifications have the following form: Select mode: (if MD = 2 then fill RS); set Screen position: GOSUB100 and repeat.

Screen position is set by drawing a line of length (zero) at the appropriate point on the screen. Addition of this accent facility considerably enhances the value of the program. ■

Vocab 32.

```
999 'INTRODUCTION
1000 CLS0:PRINT@76,"VOCAB 32";:PRINT@194,"A VERSATILE LANGUAGE-LEARNING";:PRINT@
230,"PROGRAM FOR THE DRAGON";:PRINT@386,"COPYRIGHT K & S BRAIN 100183";:SCREEN0,
1:FORN=1TO255STEP5:SOUNDN,1:NEXT:SCREEN0,0:GOTO11000
1009 'LANGUAGE SWAP
1010 SOUNDASC(Q$),2:K$=M$:L$=N$:M$=L$:N$=K$:T=F:P=E:F=P:E=T:RETURN
1019 'ARRAY SWAP
1020 C$(1)=A$(N):E$=B$(N):A$(N)=E$:B$(N)=C$(1):RETURN
1029 'MENU
1030 CLS:PRINTM$,N$:PRINT@42,"vocabulary":PRINT@98,"TO TEST YOURSELF PRESS 'T'";
PRINT@160,"TO CONSULT DICTIONARY PRESS 'D'":PRINT@228,"TO ADD WORDS PRESS 'A'":P
RINT@294,"TO LEARN PRESS 'L'":PRINT@480,"to";BL$;"reverse";BL$;"languages";BL$;"
Press 'X'";
1040 PRINT@357,"TO SAVE/LOAD PRESS 'S'":PRINT@418,"TO USE AUDIO TAPE PRESS 'U'"
1049 'MENU SELECTION
1050 Q$=INKEY$:IFQ$="T"THEN2000ELSEIFQ$="D"THEN3000ELSEIFQ$="A"THEN4000ELSEIFQ$=
"L"THEN7000ELSEIFQ$="S"THEN8000ELSEIFQ$="U"THEN9000ELSEIFQ$="X"THENGOSUB1010:GOT
O1030:ELSE1050
1999 'TEST
2000 SOUNDASC(Q$),5:CLS2:PRINT@13,"test";:PRINT@99,"FOR RANDOM WORDS PRESS 'R'";
:PRINT@161,"FOR PARTICULAR WORDS PRESS 'P'";:SCREEN0,1
2009 'RANDOM OR PARTICULAR
2010 P$=INKEY$:IFP$="R"THENPRINT@293,"HOW MANY WORDS?  ";:INPUTW:ELSEIFP$="P"THE
NGOSUB6000:GOTO5000:ELSE2010
2019 'RANDOM START
2020 H=INT(RND(Y))+1
2029 'VALID START ELSE HALVE
2030 IF(H+W)>Y THEN H=H/2
2040 IF(H+W)>Y THEN 2030ELSEIFH<1THEN H=1
2050 XA=H:YA=H+W-1:CLS5:GOTO5000
2999 'DICTIONARY
3000 SOUNDASC(Q$),5:CLS3:PRINTM$,N$:PRINT@74,"dictionary";:PRINT@453,"for";BL$;"
menu";BL$;"Press";BL$;"enter";:PRINT@166,"INPUT UNKNOWN WORD";:PRINT@224,"";:INP
UTD$:IFD$=""THEN1030ELSEIFD$="X"THENGOSUB1010:GOTO3000
3009 'SEARCH ARRAY
3010 FORN=X TO Y:IFT=0THENGOSUB1020ELSEIFD$=B$(N)THEN3050ELSEIFT=0THENGOSUB1020
3020 IFD$=B$(N)THEN3050ELSEIFT=0THENGOSUB1020
3030 NEXTN
3039 'NO MATCH
3040 PRINT@352,"word";BL$;"not";BL$;"found";:GOTO3060
3049 'MATCH
3050 PRINT@352,A$(N):IFT=0THENGOSUB1020
3060 FORN=1TO1000:NEXT:GOTO3000
3999 'ADD WORDS
4000 SOUNDASC(Q$),5:CLS0:GOSUB6000:GOSUB5000:IFT=0THENGOSUB1020
4010 RETURN
4999 'WORD DISPLAY
5000 FORN=XA TO YA:CLS:IFT=0THENGOSUB1020
5009 'TEST BRANCH 1
5010 PRINT@32,M$;:IFQ$<>"A"THEN5020ELSEPRINT@64,"";:INPUTB$(N)
5020 PRINT@64,B$(N):PRINT@256,N$
5029 'TEST BRANCH 2
5030 IFQ$<>"A"THEN5040ELSEPRINT@288,"";:INPUTA$(N):PRINT@288,A$(N):FORM=1TO500:N
EXTM:Y=YA:GOTO5050
5039 'CHECK MATCH
5040 PRINT@288,"";:INPUTC$:PRINT@384,A$(N);:FORM=1TO500:NEXT:IFC$=A$(N)THEN Z=Z+
1:SOUND150,1:ELSESOUND1,5
5050 IFT=0THENGOSUB1020
5059 'SCORE
5060 NEXTN:IFQ$="A"THENGOTO1030ELSEPRINT@490,"score = ";Z;:FORM=1TO500:NEXTM:Z=0
:GOTO1030
5999 'WORD SELECT
6000 PRINT@320,"FILE ENDS AT",Y:INPUT"START WORD NUMBER";XA:INPUT"END WORD NUMBE
R";YA:RETURN
6999 'LEARN
7000 SOUNDASC(Q$),5:CLS6:XX=0:FORN=X TO Y:XX=XX+1:PRINTA$(N),,B$(N),,,,:IFXX=5TH
EN7010ELSENEXTN:INPUTO$:GOTO1030
7010 INPUTO$:XX=0:CLS:NEXTN:GOTO1030
7999 'CASSETTE LOAD/SAVE
8000 SOUNDASC(Q$),5:CLS4:PRINT@5,"cassette";BL$;"file";BL$;"routine";:PRINT@34,"
TO LOAD WORD FILE PRESS'L'";:PRINT@66,"TO SAVE WORD FILE PRESS 'S'";
8009 'LOAD OR SAVE?
8010 CF$=INKEY$:IFCF$="L"THEN8020ELSEIFCF$="S"THEN8050ELSE8010
8019 'LOAD
8020 PRINT@134,"load";:PRINT@166,"FILE NAME";:INPUTU$:PRINT@230,"START WORD NUMB
ER  ";:PRINT@262,"CURRENT START IS  ";X;:PRINT@250,"";:INPUTFS:PRINT@294,"END WO
RD NUMBER  ";:PRINT@326,"CURRENT END IS  ";Y;:PRINT@314,"";:INPUTFE
8030 MOTORON:PRINT@384,"WHEN TAPE READY PRESS 'ENTER'";:INPUTZ$:MOTOROFF:INPUTZ$
:OPEN"I",#-1,U$:INPUT#-1,U$,M$,N$,T:FORN=FS TO FE:IFEOF(-1)THEN8040ELSEINPUT#-1,
A$(N),B$(N):NEXTN
8040 CLOSE#-1:Y=FE:PRINT@458,"file";BL$;"loaded";:SOUND50,50:Y=FE:GOTO1030
8049 'SAVE
8050 PRINT@134,"save";:PRINT@166,"FILE NAME";:INPUTU$:PRINT@230,"START WORD NUMB
ER  ";:PRINT@262,"CURRENT START IS  ";X;:PRINT@250,"";:INPUTFS::PRINT@294,"END W
ORD NUMBER  ";:PRINT@326,"CURRENT END IS  ";Y;:PRINT@314,"";:INPUTFE
8060 MOTORON:PRINT@384,"WHEN TAPE READY PRESS 'ENTER'";:INPUTZ$:MOTOROFF:INPUTZ$
:OPEN"O",#-1,U$:PRINT#-1,U$,M$,N$,T:FORN=FS TO FE:PRINT#-1,A$(N),B$(N):NEXTN:CLO
SE#-1:PRINT@458,"saved";:SOUND200,50:GOTO1030
8999 'AUDIO
9000 SOUNDASC(Q$),5:CLS7:PRINT@9,"audio";BL$;"routine":PRINT@64,"THIS ENABLES YO
U TO INCLUDE AN   AUDIO TRACK WITH THE PROGRAM";
9010 CLS3:PRINT@33,"CONNECT DRAGON CASSETTE LEADS";:PRINT@72,"TO THE RECORDER";:
GOTO9020
9020 PRINT@262,"TO RECORD PRESS 'R'";:PRINT@327,"TO PLAY PRESS 'P'";
9029 'RECORD OR PLAY?
9030 Z$=INKEY$:IFZ$="R"THEN9040ELSEIFZ$="P"THEN9110ELSE9030
9039 'AUDIO RECORDING
9040 CLS4:PRINT@8,"audio";BL$;"recording";:GOSUB10000
9050 MOTORON:PRINT@34,"WHEN TAPE AT CORRECT POINT";:PRINT@70,"PRESS 'ENTER'";:IN
PUTZ$:MOTOROFF:PRINT@97,"PRESS 'RECORD' THEN 'ENTER'";:INPUTZ$
9060 OPEN"O",#-1,"AUDIO":PRINT#-1,Z$,M$,N$,T,AE,AS:FORN=AS TO AE:PRINT#-1,A$(N),
B$(N):NEXTN:CLOSE#-1:PRINT@360,"word";BL$;"file";BL$;"saved";
9070 PRINT@418,"VOICE TRACK CAN NOW BE ADDED";:PRINT@483,"WHEN READY PRESS 'ENTE
R'";:INPUTZ$
9080 CLS4:PRINT@33,"UNPLUG DRAGON MICROPHONE LEAD";:PRINT@66,"AND REPLACE WITH M
ICROPHONE";:PRINT@162,"EACH WORD WILL BE DISPLAYED";:PRINT@197,"ON THE SCREEN IN
 TURN";:PRINT@258,"WHEN TONE SOUNDS SPEAK WORD";:PRINT@387,"TO START PRESS 'ENTE
R'";:INPUTZ$
9089 'WORD DISPLAY
9090 FORN=AS TO AE:CLS2:IFT=0THENG$=A$(N)ELSEG$=B$(N)
9100 PRINT@165,G$:PRINT@370,"";:SOUND200,2:MOTORON:FORM=1TO1000:NEXTM:MOTOROFF:P
RINT@370,"";:NEXTN:PRINT@425,"all";BL$;"words";BL$;"entered";:SOUND200,10:GOTO10
30
9109 'AUDIO PLAYBACK
9110 CLS3:PRINT@8,"audio";BL$;"Playback";:GOSUB10000
9120 PRINT@65,"WHEN READY PRESS 'ENTER'";:INPUTZ$:OPEN"I",#-1,"AUDIO":INPUT#-1,Z
$,M$,N$,T,AE,AS:FORN=AS TO AE:IFEOF(-1)THEN9130:INPUT#-1,A$(N),B$(N):NEXTN:PRINT
@360,"word";BL$;"file";BL$;"loaded";
9130 CLOSE#-1:PRINT@417,"VOICE TRACK CAN NOW BE REPLAYED";:PRINT@483,"WHEN READY
 PRESS 'ENTER'";:INPUTZ$
9139 'WORDS AND/OR SOUND?
9140 CLS2:PRINT@128,"FOR SOUND TRACK ONLY INPUT 'S'";:PRINT@192,"FOR SOUND + SCR
EEN INPUT 'B'";:INPUTZ$
9150 CLS4:FORN=XA TO YA:CLS4:IFT=0THENGOSUB1020
9160 PRINT"Press";BL$;"enter";BL$;"to";BL$;"stop";BL$;"tape";:PRINT@32,M$:IFZ$="
B"THENPRINTB$(N)
9170 MOTORON:AUDIOON:PRINT@28,"";:INPUTZZ$:MOTOROFF:AUDIOOFF:PRINT@256,N$;:PRINT
@288,"";:INPUTC$:PRINT@384,A$(N);:FORM=1TO500:NEXTM:IFC$=A$(N)THENSOUND200,1ELSE
SOUND1,5
9180 IFT=0THENGOSUB1020
9190 NEXTN:GOTO1030
9999 'WORD SELECT 2
10000 PRINT@164,"START WORD NUMBER";:PRINT@196,"FILE START IS  ";X;:PRINT@184,""
;:INPUTAS:PRINT@260,"END WORD NUMBER";:PRINT@292,"FILE END IS  ";Y;:PRINT@280,""
;:INPUTAE:RETURN
10999 'INITIALISE
11000 PCLEAR4:DIMA$(500):DIMB$(500):DIMC$(1):DIMD$:F=1:P=1:X=1:Y=1:BL$=CHR$(128)
:CLS2:PRINT@32,"enter";BL$;"languages";BL$;"to";BL$;"be";BL$;"used";:PRINT@128,"
FIRST LANGUAGE";:INPUTM$:SOUND20,1:PRINT@224,"SECOND LANGUAGE";:INPUTN$:SOUND50,
1:GOTO1030
```

Additional lines for accent capability.

```
1 CLEAR 10000:PCLS
9 'JUMP DRAW ROUTINES
10 GOTO1000
19 'VALID CHARACTER?
20 CC=ASC(CC$):IFCC<32ORCC>90THENRETURN
29 'SELECT CHR LINE
30 ON CC-31 GOSUB32,33,34,35,36,37,38,39,40,41,42,43,44,45,46,47,48,49,50,51,52,
53,54,55,56,57,58,59,60,61,62,63,64,65,66,67,68,69,70,71,72,73,74,75,76,77,78,79
,80,81,82,83,84,85,86,87,88,89,90:RETURN
31 'DRAW CHR ROUTINES
32 DRAW"BM+8,+0":RETURN
33 RETURN
34 DRAW"BM+0,-6D8M+2,+0UBM+4,+6":RETURN
35 DRAW"BM-7,-7E3BM+4,+10":RETURN
36 DRAW"BM-4,-7H3BM+7,+10":RETURN:RETURN
37 DRAW"BM-8,-7E2F2BM+4,+7":RETURN
38 DRAW"BM-6,+1DGBM+7,-3":RETURN
39 DRAW"BM+0,-6DBM+4,+5":RETURN
40 DRAW"BM+2,+0HU4EBM+4,+6":RETURN
41 DRAW"BM+1,+0EU4HBM+5,+6":RETURN
42 DRAW"BM+0,-1E4BM+0,+4H4BM+8,+5":RETURN
43 DRAW"BM+0,-3R4L2U2D4BM+5,+1":RETURN
44 DRAW"BM-1,+0DGBM+4,-2":RETURN
45 DRAW"BM+0,-3R4BM+4,+3":RETURN
46 DRAW"BM-1,+0UBM+4,+1":RETURN
47 DRAW"BM+0,-1E4BM+4,+5":RETURN
48 DRAW"BM+0,-1FR2EU4HL2GD4BM+8,1":RETURN
49 DRAW"BM+2,+0U6GBM+7,+5":RETURN
50 DRAW"BM+4,+0L4UER2EU2HL2GBM+8,+5":RETURN
51 DRAW"BM+0,-1FR2EUHL2R2EUHL2GBM+8,+5":RETURN
52 DRAW"BM+3,+0U6G3R4BM+4,+3":RETURN
53 DRAW"BM+0,-1FR2EU2HL3U2R4BM+4,+6":RETURN
54 DRAW"BM+0,-2ER2FDGL2HU4ER2FBM+4,+5":RETURN
55 DRAW"BM+2,+0U2E2U2L4BM+8,+6":RETURN
56 DRAW"BM+1,+0R2EUHL2HUER2FDGL2GDFBM+7,+0":RETURN
57 DRAW"BM+0,-1FR2EU4HL2GDFR3BM+4,+3":RETURN
58 DRAW"BM+0,-5DBM+0,+2DBM+4,+1":RETURN
59 DRAW"BM+0,-5DBM+0,+2DGBM+5,+0":RETURN
60 RETURN
61 DRAW"BM+0,-2R4BM+0,-2L4BM+8,+4":RETURN
62 RETURN
63 DRAW"BM+2,+0UBM+0,-1UREUHLGBM+7,+5":RETURN
64 RETURN
65 DRAW"U5ER2FD5U3L4BM+8,+3":RETURN
66 DRAW"U6R3FDGFDGL3U3R3BM+5,+3":RETURN
67 DRAW"BM+1,+0HU4ER2FHL2GD4FR2EBM+4,+1":RETURN
68 DRAW"U6R3FD4GL3BM+8,+0":RETURN
69 DRAW"R4L4U3R4L4U3R4BM+4,+6":RETURN
70 DRAW"U3R4L4U3R4BM+4,+6":RETURN
71 DRAW"BM+1,+0R2EULRDGL2HU4ER2FBM+4,+5":RETURN
72 DRAW"U6D3R4U3D6BM+4,+0":RETURN
73 DRAW"BM+2,+0R2LU6LR2BM+4,+6":RETURN
74 DRAW"BM+0,-1FR2EU5BM+4,+6":RETURN
75 DRAW"U6BM+0,+3RE3G3F3BM+4,+0":RETURN
76 DRAW"R4L4U6BM+8,+6":RETURN
77 DRAW"U6F2E2D6BM+4,+0":RETURN
78 DRAW"U6DF4DU6BM+4,+6":RETURN
79 DRAW"BM+1,+0R2EU4HL2GD4FBM+7,+0":RETURN
80 DRAW"U6R3FDGL3BM+8,+3":RETURN
81 DRAW"BM+1,+0R2EU4HL2GD4FBM+1,-2F2BM+4,+0":RETURN
82 DRAW"U6R3FDGL3RF3BM+4,+0":RETURN
83 DRAW"BM+0,-1FR2EH4ER2FBM+4,+5":RETURN
84 DRAW"BM+2,+0U6L2R4BM+4,+6":RETURN
85 DRAW"BM+0,-6D5FR2EU5BM+4,+6":RETURN
86 DRAW"BM+0,-6D4F2E2U4BM+4,+6":RETURN
87 DRAW"BM+0,-6D6E2F2U6BM+4,+6":RETURN
88 DRAW"UE4UBM+0,+6UH4UBM+8,+6":RETURN
89 DRAW"BM+2,+0U4H2F2E2BM+4,+6":RETURN
90 DRAW"R4L4UE4UL4BM+8,+6":RETURN
99 'HI-RES SCREEN - READ OR INPUT?
100 PMODE4,1:SCREEN1,0:COLOR0,1:DRAW"S4":ON MD GOSUB200,300:RETURN
199 'INPUT AND ERASE ROUTINE
200 CC$=INKEY$:IFCC$=""THEN200ELSEIFCC$=CHR$(13)ANDLEN(TM$)>0THENRETURNELSEIFCC$
<>CHR$(8)THENGOSUB20:TM$=TM$+CC$:GOTO200:ELSEDRAW"C1BM-8,+6U10RD10RU10RD10RU10RD
10BM-5,-6C0"
210 LA$=RIGHT$(TM$,1):LA=ASC(LA$):IFLA<35OR LA >39THENTM$=LEFT$(TM$,LEN(TM$)-1):
GOTO200:ELSE TM$=LEFT$(TM$,LEN(TM$)-2):GOTO200
299 'READ STRING
300 FORJ1=1TOLEN(R$):CC$=MID$(R$,J1,1):GOSUB20:NEXT:RETURN

2999 'DICTIONARY
3000 SOUNDASC(Q$),5:PCLS1:MD=2:R$=M$+"/"+N$:DRAW"BM10,10":GOSUB100:R$="DICTIONAR
Y":DRAW"BM60,30":GOSUB100:R$="FOR MENU PRESS NEWLINE":DRAW"BM40,180":GOSUB100:R$
="INPUT UNKNOWN WORD":DRAW"BM40,60":GOSUB100:MD=1:DRAW"BM50,90":GOSUB100:D$=TM$:
TM$=""
3005 IFASC(D$=13)THEN1030ELSEIFD$="X"THENGOSUB1010:GOTO3000
3010 FORN=X TO Y:IFT=0THENGOSUB1020ELSEIFD$=B$(N)THEN3050ELSEIFT=0THENGOSUB1020
3020 IFD$=B$(N)THEN3050ELSEIFT=0THENGOSUB1020
3030 NEXTN
3040 MD=2:R$="WORD NOT FOUND":DRAW"BM50,120":GOSUB100:GOTO3060
3050 MD=2:R$=A$(N):DRAW"BM50,120":GOSUB100:IFT=0THENGOSUB1020

4999 'WORD DISPLAY
5000 FORN=XA TO YA:IFT=0THENGOSUB1020
5010 PCLS1:MD=2:R$=M$:DRAW"BM10,20":GOSUB100:IFQ$<>"A"THEN5020ELSEMD=1:DRAW"BM20
,40":GOSUB100:B$(N)=TM$:TM$=""
5020 MD=2:R$=N$:DRAW"BM10,100":GOSUB100:R$=B$(N):DRAW"BM20,40":GOSUB100
5030 IFQ$<>"A"THEN5040ELSEMD=1:DRAW"BM20,120":GOSUB100:A$(N)=TM$:TM$="":FORM=1TO
500:NEXTM:Y=YA:GOTO5050
5040 MD=1:DRAW"BM20,120":GOSUB100:C$=TM$:TM$="":MD=2:R$=A$(N):DRAW"BM20,160":GOS
UB100:FORM=1TO500:NEXT:IFC$=A$(N)THEN Z=Z+1:SOUND150,1:ELSESOUND1,5
5050 IFT=0THENGOSUB1020
5060 NEXTN:IFQ$="A"THENGOTO1030ELSEMD=2:DRAW"BM50,185":R$="SCORE = "+STR$(Z):GOS
UB100:FORM=1TO500:NEXT:Z=0:GOTO1030

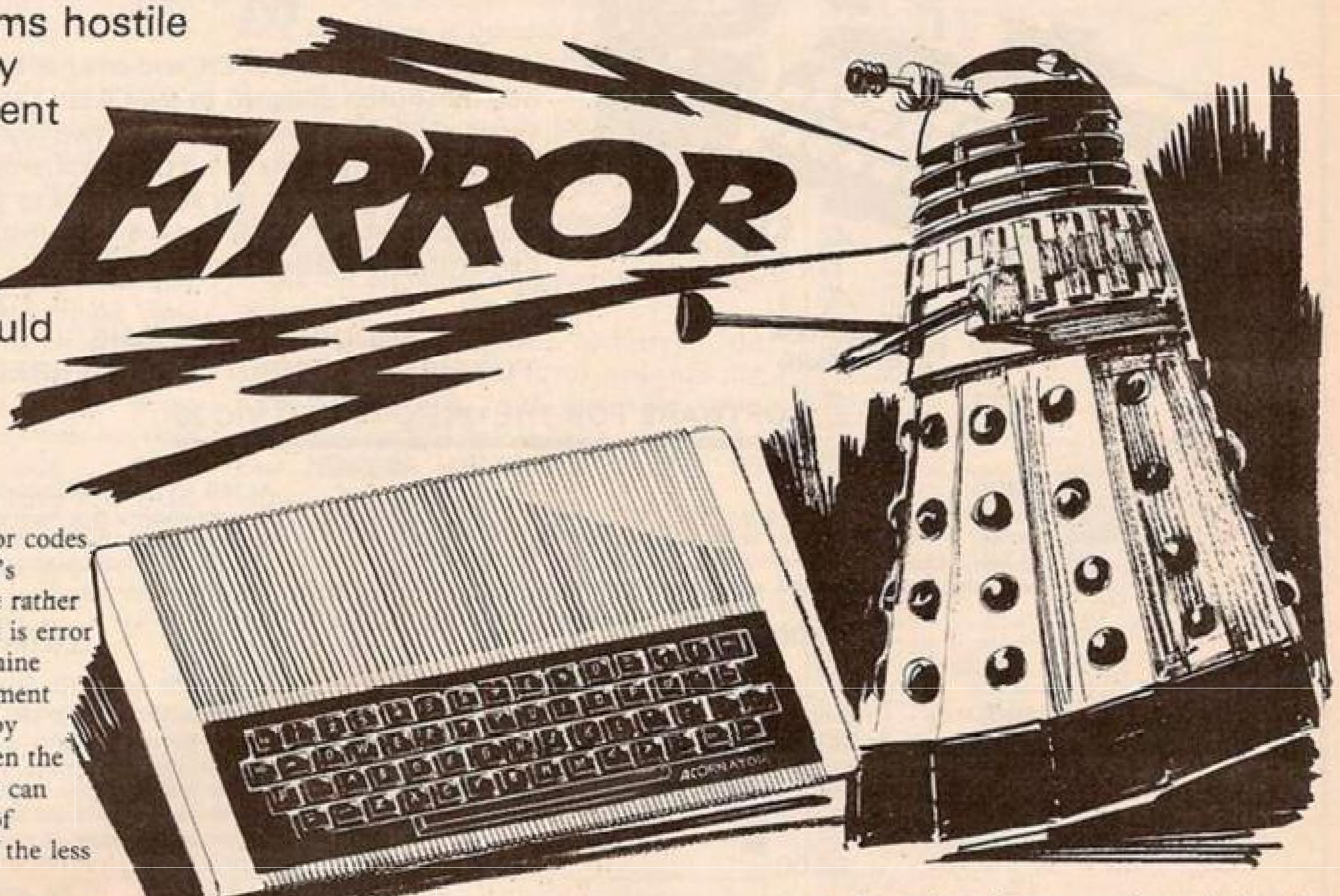
6999 'LEARN
7000 SOUNDASC(O$),5:PCLS:XX=0:FORN=X TO Y:MD=2:LINE(10,XX+10)-(10,XX+10),PRESET:
R$=A$(N):GOSUB100:LINE(10,XX+20)-(10,XX+20),PRESET:R$=B$(N):GOSUB100:XX=XX+30:IF
XX=150THEN7010ELSENEXTN
7005 O$=INKEY$:IFO$=""THEN7005ELSE1030
7010 O$=INKEY$:IFO$=""THEN7010ELSEXX=0:PCLS:NEXTN:GOTO1030

9089 'WORD DISPLAY
9090 FORN=AS TO AE:PCLS:IFT=0THENG$=A$(N)ELSEG$=B$(N)
9100 MD=2:R$=G$:DRAW"BM40,40":GOSUB100:SOUND200,2:MOTORON:FORM=1TO1000:NEXTM:MOT
OROFF:NEXTN:R$="ALL WORDS ENTERED":DRAW"BM40,160":GOSUB100:SOUND200,10:GOTO1030

9149 'AUDIO + WORD DISPLAY
9150 FORN=AS TO AE:PCLS:IFT=0THENGOSUB1020
9160 MD=2:R$="PRESS ENTER TO STOP TAPE":DRAW"BM10,10":GOSUB100:R$=M$:DRAW"BM10,3
0":GOSUB100:IFZ$="B"THENR$=B$(N):DRAW"BM10,50":GOSUB100
9170 MOTORON:AUDIOON:ZZ$=INKEY$:IFZZ$=""THEN9170ELSEMOTOROFF:AUDIOOFF:R$=N$:DRAW
"BM10,100":GOSUB100:MD=1:DRAW"BM10,120":GOSUB100:C$=TM$:TM$="":MD=2:R$=A$(N):DRA
W"BM10,150":GOSUB100:FORM=1TO500:NEXTM:IFC$=A$(N)THENSOUND200,1ELSESOUND1,5
```

EASY ATOM CODES

If your Atom seems hostile about giving away information, Vincent Fojut's error-message handler might not exterminate all errors — but should certainly help you correct them.



PUTTING IT KINDLY, the error codes provided by the Acorn Atom's standard error handler can be rather unhelpful at times. Just what is error 191? Newcomers to the machine need a little more encouragement if they are not to be put off by their inevitable mistakes. Even the more experienced Atom user can save himself the frustration of checking on the meanings of the less frequent error codes.

The short machine-code program — listing 2 — alleviates the problem by providing an English language error-message handler in place of the standard error routine. For maximum utility, the normal error codes and Basic line number references are still provided. Total memory requirements, for the machine code and error-message data table, are in the order of 1.25K, though this will very depending on the length and number of the error messages stored.

Before we can print the English messages for each error, we first need a convenient means of entering them into the machine. The Basic program in listing 1 facilitates the required data entry. As you can see from the short sample run in figure 1, the entry program prompts the user for an error code, which must be between 0 and 255 inclusive, and then its associated error message is requested.

As a helpful starting point, a list of all the operating system errors, and their respective translations into English, can be found in the Atom user manual, *Atomic Theory and Practice*, on pages 205 to 209. The meaning of each error can be typed in verbatim, if desired. There is, however, nothing to stop you modifying these messages — shortened lengthened, rephrased or typed in Swahili — to suit your own particular requirements.

To terminate data entry, type 999 in response to the Error number? prompt. Alternatively, the program will terminate automatically if there is insufficient memory to store another error message — see lines 340 to 360, listing 1.

When data entry is completed, the program returns the number of messages stored, and prints a suitable COS command to save the entire message table for future use. The lazier ones amongst you, who wish to avoid retyping, can enter this command by using the cursor-control and Copy keys.

Once the data table has been created and stored, the Basic program is no longer required. It can safely be overwritten by your current program or application. Remember that if you wish to use mode 4, the highest resolution graphics, you will need to store the machine-code routine and the data table in lower text space, say, at # 3700 onwards, as in the program examples. If mode 4 is not required, then anywhere in the upper 3K of graphics RAM — # 8C00 to # 97FF — can be used.

Figure 2 shows how the messages are stored in the data table. Each entry consists of an error number, followed by a message in ASCII. Both upper- and lower-case ASCII characters are permitted. Note, however, that the byte containing the first character in each ASCII string has its top bit set to 1. This gives the new error routine a convenient means of detecting the end of any message string — it need only look for a byte with a negative value.

The end of the message table is marked by two consecutive bytes of value zero. You may perhaps wonder why two bytes were necessary, as opposed to just one, since there is no Basic error with a number of 0. The reason is that the value zero could itself be a valid error code — as could any eight-bit value — if the routine were to be used by machine-code programs. Since no restriction has been placed on the order of error numbers during data entry, it follows that an error code of zero could occur anywhere in the message table. A double-byte end-of-table marker avoids any such potential confusion.

Listing 2 details the modified error-handling routine. The Break vector at # 202, # 203 is modified so that whenever a 6502 BRK instruction is executed — for example during the normal trapping of a Basic error — processing is rerouted via this program. The routine scans through the user-defined error message table until a match is found for the current error number stored on the processor stack. As soon as a match is found, the appropriate message string is printed. This is followed by the standard Atom error output, so that you can isolate the offending Basic line.

If no match for the error code can be found, the program jumps straight into the normal Atom error routine.

In testing this routine, I hit upon what appears to be a little-known fact about the Acorn Atom. The BRK vector — BRKVEC at # 202, # 203 — unlike the other operating system vectors, cannot be changed by Basic in direct mode. To demonstrate this, try entering the following directly — that is, without line numbers:

```
?# 204=# AB;?# 205=# CD change IRQ
  vector
P.&?# 204,&?# 205 should give AB,CD —
  that is, vector changed
```

Press Break to restore the IRQ vector's original contents, # A000. However:

```
?# 202=# AB;?# 203=# CD change BRK
  vector
```

(continued on page 109)

ZX Spectrum JOYSTIX ! VIC 20 SOFTWARE



FROM INTERCEPTOR MICRO'S

At last, the ultimate in ZX add-ons has arrived. The unique board has been designed to take Atari* type or Commodore× type joystix. The board will take two joysticks+ which are software programable using the in statement on your Spectrum. Just add a few simple lines to your programs for true arcade action. Supplied with full instructions and demonstration cassette for only

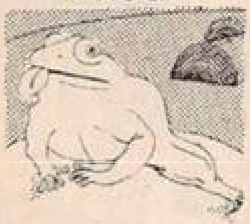
£15.95

INTERCEPTOR SOFTWARE

TRADE ENQUIRIES WELCOME
FOREIGN DISTRIBUTORS REQUIRED

SOFTWARE FOR THE UNEXPANDED VIC 20

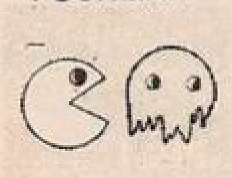
FROG



FROG
An amazing version of Frogger in the unexpanded VIC 20. With diving turtles and plenty of vehicles to run you down. Fast action and high resolution graphics. Joystix or Keyboard control

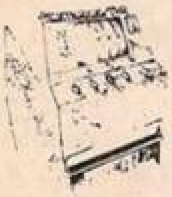
....£4.00

PUCKMAN



PUCKMAN – MACHINE CODE
The old favourite back again. Joystix or keyboard control. Fast action. High resolution colour graphics on the unexpanded VIC 20

....£6.00



PENNY SLOT
This program is designed around a penny slot machine and gives true to life animated action. Try your luck to win a fortune. For Vic 20. With hold and nudge features for only

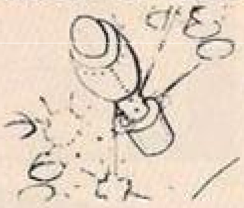
....£4.50



VIC BOMBER
An extremely fast action Bomber game for the Vic 20. With high resolution colour graphics. Flatten the enemy city before it's too late.

....£3.00

ALIEN ATTACK



ALIEN ATTACK – MACHINE CODE
You are under attack from an immense force. This program has various ways for you to battle against giving an extra-terrestrial experience for any adventurous human being

....£6.00

VIC RESCUE



VIC RESCUE – MACHINE CODE
Your Planet is under attack by a fourth dimension and your only escape is by lunar-pod to the mother ship. However you must first dodge your way through the Astroid belt and onto the landing pad before returning home. Keyboard or Joystix control, high resolution colour graphics

....£5.00

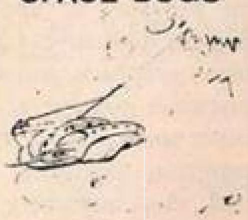
GALAXZIONS



GALAXZIONS – MACHINE CODE
This is the most amazing alien game ever seen on the VIC 20. Galaxzions swarming in attack formation to destroy your planet. The nearest program to the real arcade game for the unexpanded VIC 20

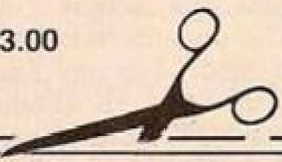
....£7.00

SPACE BUGS



SPACE BUGS – MACHINE CODE
Can you defend your planet from an alien invasion. The Marauding bugs are swarming in for the kill. So keep on your toes, joystix or keyboard

....£4.00



Mr. Mrs. Miss
Address

Quantity	Item	Unit Price	Total
	Joystix Board (Spectrum)	£15.95	
	Galaxzions Vic 20	£7.00	
	Space Bugs Vic 20	£4.00	
	Frog Vic 20	£4.00	
	Alien Attack Vic 20	£6.00	
	Bomber Vic 20	£3.00	
	Puckman Vic 20	£6.00	
	Space travel Vic 20	£5.00	
	Vic Rescue Vic 20	£5.00	
	Penny Slot Vic 20	£4.50	
	Wordhanger Atari	£5.00	
	Postage & Packing		50P
	TOTAL		

Send order to: Interceptor Micro's, Lindon House, The Green, Tadley, Hants — Please add P&P

WORDHANGER

ATARI 400 800 16K



WORDHANGER
A highly educational hangman game with vocabulary and 2 player or play against the computer option

....£5.00

COMING SOON

CRAZY KONG
Unexpanded VIC 20

FANTAZIA
Unexpanded Vic 20

WATCH THIS SPACE

* JOYSTIX SHOWN NOT INCLUDED

(continued from page 107)

*P.&?#202,&?#203 still gives D8,C9 — that is, vector not changed

As far as our new routine is concerned, the effects of this are twofold. Firstly, any program which uses the new error handler must immediately alter the BRK vector to the new start address. Secondly, the new messages will not be displayed for Basic errors caused by a direct-mode line, unless the same Basic line redirects the BRK vector first. In practice, this second point is no real problem. Any direct-mode error will obviously be due to the line just entered and should, therefore, be relatively easy to identify.

Now that you have entered or loaded your message table and modified error routine, how do you use it? Figure 3 shows a simple Basic program which causes the new error handler to be executed. Note that the very first thing the program does is to change the BRK vector — we assume that the machine code has been stored at address #3700 onwards.

Once this is done, you may enter your Basic program as normal. You have the added assurance that when run, your program will be able to identify any errors in as precise and as meaningful a way as you choose — see the sample run in figure 3.

Machine-code programs may also use the error handler to good effect. As an example, consider the program in figure 4. The routine adds #40 to the value stored at address #0090. If the byte at this address is #3F or less, then the sum of the addition is stored at address #0091, as in Sample run A. If the byte is # or greater, then the addition will set the processor's overflow flag. When such an overflow occurs, a suitable error message can be displayed by invoking the new error handler via a BRK instruction — see Sample run B.

The value of the error code generated by any BRK instruction is calculated by adding 2 to the BRK instruction's address, and shedding the high byte of the result. In the example in figure 4, the BRK will be located at #3614, which generates an error number of #3614+2=#3616=a low byte of #16 or 22 decimal. If a suitable error message is added to the message table for this error number, then it will be displayed whenever the overflow occurs.

Note that, like its Basic counterpart, the machine-code program firstly redirects the BRK vector. This must always be done, unless the machine code is being called from a Basic program which itself modifies the vector.

The more adventurous may like to modify the data-entry program so that control characters may be easily embedded within the error-message strings. This could for example enable you to clear the screen before displaying certain error messages.

In addition, the size of the message table could be reduced to some extent through the use of text compression techniques, with text expansion routine in the new error handler. Concise message phrasing also helps. ■

Listing 2.

```
10 REM*************************************************************
20 REM  ENHANCED ERROR HANDLER FOR ACORN ATOM.
30 REM  ALLOWS STANDARD ERROR CODES TO BE PRECEDED BY A
40 REM  USER-SUPPLIED ENGLISH (OR ANY OTHER) LANGUAGE ERROR
50 REM  MESSAGE.
60 REM  (C) V. FOJUT. 1982.
70 REM*************************************************************
80 REM
90 DIM LL(10)
100 FOR N=0 TO 10; LL(N)=-1; NEXT N
110 M=#80; Z=#82; REM ZERO-PAGE MEMORY USED BY ROUTINE
120 INPUT "ASSEMBLE FROM (HEX)" H
130 INPUT "START ADDRESS OF MESSAGE TABLE  (HEX)" T
140 FOR N=1 TO 2; P=H
150[
160:LL0 STA Z        \save
170     STX Z+1      \registers.
180     STY Z+2
190     LDA @T/256   \set
200     STA M+1      \up
210     LDA @T%256   \table
220     STA M        \pointer.
230     TSX
240     LDY @0       \initialise Y.
250:LL1 LDA (M),Y    \current error
260:LL2 CMP #102,X   \in table?
270     BEQ LL4      \branch if so.
280:LL3 JSR LL7      \get next char.
290     BPL LL3      \until end of mess. string
300     JSR LL7      \get next err.no.
310     BNE LL2      \if not zero.
320     JSR LL7      \end of table?
330     BEQ LL6      \branch if so
340     TYA          \else
350     BNE LL9      \check
360     DEC M+1      \table
370:LL9 DEY          \for
380     CLC          \error
390     BCC LL1      \code.
400\
410\ entry found for current error - print message
420\
430:LL4 JSR #FFED    \CR/LF
440:LL5 JSR LL7      \get next char.
450     PHA          \save char.
460     AND @#7F     \mask out top bit.
470     JSR #FFF4    \print char.
480     PLA          \restore char.
490     BPL LL5      \continue if more.
500\
510\ end of string
520\
530:LL6 LDA Z        \restore
540     LDX Z+1      \registers.
550     LDY Z+2
560     PLP          \get copy
570     PHP          \of status
580     JMP #C9D8    \jump to
590                  \standard
600                  \err.handler.
610\
620\ get next char. routine.
630\
640:LL7 INY          \increment
650     BNE LL8      \table
660     INC M+1      \pointer.
670:LL8 LDA (M),Y    \get next char.
680     RTS          \return.
690]
700 NEXT N
710 @=1
720 PRINT " *SAVE""ERRPROC"""&H" "&P"
730 END
```

Figure 1.

```
>RUN

WHEN PROMPTED, ENTER AN ERROR
NO., FOLLOWED BY AN ASSOCIATED
ERROR MESSAGE OF YOUR CHOICE.
TO TERMINATE, ENTER AN ERROR NO.
 OF '999'

START ADDRESS OF MESSAGE TABLE  (HEX) ?#3800

ERROR NUMBER?69
ENTER MESSAGE
?Illegal FDIM statement

ERROR NUMBER?22
ENTER MESSAGE
?Signed arithmetic overflow

ERROR NUMBER?91
ENTER MESSAGE
?No hexadecimal number after "#"

ERROR NUMBER?999

NUMBER OF ENTRIES = 3

 *SAVE"ERRTAB"3800 3854
```

Figure 2.

```
3800- 45  (BASIC Floating-Point error number)

3801- 49 6C 6C 65 67 61 6C 20 46 44 49 4D 20 73 74 61 74 65 6D 65 6E F4
      I  l  l  e  g  a  l     F  D  I  M     s  t  a  t  e  m  e  n  t+#80

3817- 16  (Machine Code error number - see Figure 4)

3818- 53 69 67 6E 65 64 20 61 72 69 74 68 6D 65 74 69 63
      S  i  g  n  e  d     a  r  i  t  h  m  e  t  i  c

3829- 20 6F 76 65 72 66 6C 6F F7
         o  v  e  r  f  l  o  w+#80

3832- 5B  (BASIC error number)

3833- 4E 6F 20 68 65 78 61 64 65 63 69 6D 61 6C
      N  o     h  e  x  a  d  e  c  i  m  a  l

3841- 20 6E 75 6D 62 65 72 20 61 66 74 65 72 20 22 23 A2
         n  u  m  b  e  r     a  f  t  e  r     "  #  "+#80

3852-  0  0  (End of Table marker)
```

Listing 1.

```
10 REM ***********************************************************
20 REM ERROR MESSAGE ENTRY PROGRAM FOR ACORN ATOM.
30 REM STORES AN ASSOCIATED MESSAGE FOR EACH ERROR CODE ENTERED
40 REM (C) V. FOJUT. 1982.
50 REM
60 REM INSTRUCTIONS **********************************************
70 PRINT '"WHEN PROMPTED, ENTER AN ERROR"'
80 PRINT "NO., FOLLOWED BY AN ASSOCIATED  ERROR MESSAGE OF "
90 PRINT "YOUR CHOICE."'
100 PRINT "TO TERMINATE, ENTER AN ERROR NO. OF '999'"''
110 REM
120 INPUT "START ADDRESS OF MESSAGE TABLE  (HEX) " M
130 Z=M;       REM SAVE TABLE ADDRESS
140 T=0;       REM FLAG T = "FALSE"
150 N=0;       REM NO. OF ENTRIES
160 REM
170 DO
180   PRINT
190   DO
200     INPUT "ERROR NUMBER" E
210   UNTIL (E)=0 AND E(256) OR E=999
220   IF E=999 THEN T=1; GOTO x; REM  CHECK FOR TERMINATION.
230   ?M=E;                      REM  PUT ERROR CODE IN TABLE
240   M=M+1;                     REM  INCREMENT POINTER.
250   DO
260     PRINT "ENTER MESSAGE"'
270     INPUT $M
280   UNTIL LEN(M)>0
290   N=N+1;                     REM  INCREMENT NO. OF ENTRIES
300   M=M+LEN(M);                REM  POINT TO NEXT FREE BYTE
310                              REM  PAST END OF MESSAGE.
320   M?-1=M?-1+#80;             REM  SET TOP BIT OF LAST
330                              REM  CHAR. IN MESSAGE.
340   M?66=#55;                  REM  CHECK IF ENOUGH MEMORY
350   IF M?66&2()#AA THEN PRINT''OUT OF MEMORY"'; T=1
360                              REM  T='TRUE' IF OUT OF MEM.
370xUNTIL T;                     REM  I.E. UNTIL FLAG T='TRUE'
380 REM
390 ?M=0; REM END OF TABLE MARKER
400 @=1
410 PRINT "NUMBER OF ENTRIES = " N'
420 PRINT " *SAVE""ERRTAB"""&Z" "&M+2"
430 END
```

Figure 4.

```
  10 DIM LL(1)
  20 FOR N=0 TO 1; LL(N)=1; NEXT N
  30 FOR N=1 TO 2; P=#3600
  40 [
  50:LL0 LDA @0      \set up
  60     STA #202 \vector
  70     LDA @#37 \for new
  80     STA #203 \err. routine
  90              \(start address
 100              \of #3700 assumed)
 110     LDA #90
 120     CLC
 130     ADC @#40
 140     BVS LL1     \overflow?
 150     STA #91
 160     RTS
 170:LL1 BRK         \IRQ to err.
 180                 \handler.
 190]
 200 NEXT N; END
--- ( "RUN" to assemble machine code ) ---
- Sample run A - (no error)
>?#90=#3F
>LINK#3600
>P.&?#91 '
    7F
- Sample run B - (overflow)
>?#90=#40
>LINK#3600
Signed arithmetic overflow
ERROR 22
```

Figure 3.

```
 10 ?#202=0;?#203=#37; REM SET UP VECTOR FOR NEW ERR. ROUTINE
 20                    REM (START ADDRESS OF #3700 ASSUMED)
 30 A=#7F
 40 B=#T               REM THIS MONTH'S DELIBERATE MISTAKE!
 50 C=A+B
 60 PRINT C
 70 END

>RUN

No hexadecimal number after "#"
ERROR 91 LINE       40
```

COMPETITION-PRO JOYSTICK

PRECISION GAME CONTROL!



For **ZX SPECTRUM**
Complete with stylish interface unit simply plug in for instant arcade action.

ONLY £25.00 inc. VAT

Outstanding Features

- Super strong nylon and steel construction, built to last.
- A total of 8 directions plus 2 large fire buttons.
- Arcade proven moulded leaf switches ensure incredible reliability.
- Complete with self contained boxed interface which simply plugs into the Spectrum expansion port (with or without printer).
- Easily programmed in BASIC or M/C.

These arcade games, designed exclusively for the **Joystick** by leading software houses, are now available for Spectrum:

3D-Tunnel	M/C	16/48K	£4.95
Gulp Man	M/C	16K	£4.95
Time Gate	M/C	48K	£6.95
Meteroids	M/C	16K	£5.95
Spooky Man	M/C	16K	£4.95

Watch this space for more software!

KEMPSTON MICRO ELECTRONICS

180a Bedford Road, Kempston, Bedford MK42 8BL

I wish to order:

Quantity	Item	Price
	Post & Packing	£1.00
	Total (VAT inclusive)	

Cheques/Postal orders should be made payable to Kempston (Micro) Electronics

Name ____________

Address ____________

Post to Kempston (Micro) Electronics, Dept YC4
180a Bedford Road, Kempston, Bedford MK42 8BL

EDUCATIONAL COMPUTING on the ZX81

Suit children ages 5-11

strongly recommended by educational authorities

No comparable collection offers so much for so little

Fifty high-quality programs to turn your ZX81 or Spectrum into a powerful educational tool.

And you don't even need to know programming. There are clear instructions and plenty of tips & advice. Designed to go beyond drill & practice the promote learning through interaction & discovery.

Almost all programs work on the **SPECTRUM**

All programs fit 1K
Creative use of graphics
Many innovative ideas
Fully documented
Includes many games

Educare's **50** 1K PROGRAMS for PRIMARY EDUCATION

Includes:-

TORTOISE
A simplified version of the famous Turtle programme

CODED MISSILE
Combines the fun of arcade games with learning

£5·95 only
paperback 110 pages plus Spectrum supplement

Graph-plotter ● Histogram ● Simon-spell ● Sketchboard ● Times-table ● Sets
Series-quiz ● XY-coordinates ● Count ● Equations ● Areas ● Guess-a-Volume
Angles ● Upstairs-Downstairs ● Music-notes ● See-saw ● Wipe-out ● Spell
Temperature ● Clock ● Money ● Snake
Mastermind ● Number-shoot ● +26 more

EDUCARE

To: EDUCARE
139a Sloane St.
London
SWIX 9AY

Please send me .... copies Educare's 50.
I enclose cheque/postal order for £ ....
Name ....
Address ....

Let your child benefit early · Send now

r q FORTH — BBC FORTH TOOLKIT

"r q FORTH" runs on 16K or 32K BBC micros and costs £15. It:
* follows the FORTH-79 STANDARD and has fig-FORTH facilities;
* provides 260 FORTH words;
* is infinitely extensible;
* has a full-screen editor;
* allows full use of the M.O.S;
* permits use of all graphic modes, even 0-2 (just!);
* provides recursion easily;
* runs faster than BBC BASIC;
* needs no added hardware;
* includes a 70 page technical manual and a summary card;
* has hundreds of users.

Level 9 Computing are pleased to announce a new toolkit for "r q FORTH" on 32K BBC micros. It costs only £10 and adds the following facilities to FORTH:
* a 6502 assembler, providing machine-code within FORTH;
* turtle graphics, giving you easy-to-use colour graphics;
* decompiler routines, allowing the versatile examination of your compiled FORTH programs;
* the full double-number set;
* an example FORTH program and demonstrations of graphics;
* other useful routines.

nascom

Extension Basic . £15/£30 ROM
Adds 30 new keywords to BASIC
Compression Assembler 2 . £12
Small source + high speed

Asteroids .... m/c,g £7.90
Galaxy Invaders . m/c,g £5.90
Missile Defence . m/c,g £7.90
Super Gulp .... eb,g £4.90
5-games cassette . misc £5.90
(FULL RANGE IN CATALOGUE)

adventures
Spectrum BBC nascom

1) COLOSSAL ADVENTURE: The classic mainframe game "Adventure" with all the original treasures & creatures + 70 extra rooms.

2) ADVENTURE QUEST: Through forest, desert, mountains, caves, water, fire, moorland and swamp on an epic quest vs Tyranny.

3) DUNGEON ADVENTURE: The vast dungeons of the Demon Lord have survived His fall. Can you get to their treasures first?

Every Level 9 adventure has over 200 individually described locations and is packed with puzzles - a game can easily take months to complete. Only sophisticated compression techniques can squeeze so much in! Each game needs 32K and costs £9.90

ALL PRICES INCLUDE P&P AND VAT - THERE ARE NO EXTRAS. Please send order or SAE for catalogue, describing your micro, to:

LEVEL 9 COMPUTING
Dept Y, 229 Hughenden Road, High Wycombe, Bucks. HP13 5PG

BASIC DICTIONARY

This dictionary, compiled by Tony Edwards, will explain the function of common Basic words as used in popular machines, enabling you to work out your own machine's equivalent. A useful complement to our recent series on Basic dialect translation.

BASIC DICTIONARY

PROC A reserved word which starts a user-declared numeric procedure on the BBC Micro.

PTR An unusual statement pair used by the BBC Microcomputer to allow selection of the next byte to be transferred between program and file, giving random type access.

R

R. The TRS-80, level 1, and Palo Tiny Basic abbreviation for the RUN command.

RAD A function which converts degrees to radians.

RANDOM A statement which resets the seed to be used for the random number generator. Its use — usually without argument — allows different pseudo-random series to be generated each run.

RANDOMISE The standard ANSI word — though little used — for the RANDOM functions.

REA The PDP-80E abbriviation for READ. The same abbreviation followed by a full stop is used in TRS-80 level 1 and Palo Alto Tiny Basic.

READ A standard ANSI statement which causes data to be read from a Data line elsewhere in the program. The read data are assigned to variables.

RECALL The Apple II function which causes the computer to input data from a cassette drive.

RENAME The statement used to rename a current file. It requires two arguments, the old name and the new name.

REM A standard ANSI word used to indicate that the interpreter should ignore the following line or part of a line.

REMARK The same statement as REM.

RENUM The Microsoft abbreviation for RENUMBER.

RENUMBER The command which re-numbers the lines of a resident Basic program and simultaneously adjusts the addresses to Jump commands to maintain program logic.

REPEAT . . . . UNTIL A BBC Micro statement. It produces a loop which is repeated until the specified condition is true. A single REPEAT may have multiple UNTILs. This statement is not often available in Basic but can be simulated — see *Your Computer,* June 1982 page 44.

RES The PDP-8E abbreviation for RESTORE.

RESET The TRS-80 statement which switches off a specified pixel.

REST. The TRS-80, level 1, abbreviation for RESTORE.

RESTORE A standard ANSI word which causes the DATA pointer to be reset. This has the effect of causing the next READ statement to operate on the first of a program's data. In some machines a partial RESTORE is possible.

RESUME The statement used as a target of an ON ERROR GOTO routine. It directs the computer to continue execution from the line named in the argument.

RET The PDP-8E abbreviation for the RETURN statement. The TRS-80 level 1 and Palo Alto Tiny Basic use the same abbreviation followed by a full stop.

RETURN The standard ANSI statement used to complete a GOSUB routine.

RIGHT A function which isolates a specified number of string characters starting from the right-most character. It is sometimes used with a "$" appended.

RND A standard ANSI function which returns a random number. Its use is non-standard in some Basics and details are given in *Your Computer,* August 1982, page 59. The statement RND (–X) when used on the Apple II is equivalent to RANDOM.

RU An abbreviation for RUN.

RUN A command which causes a computer to start executing the program resident in its memory.

S

S. The TRS-80 level 1 and Palo Alto Tiny Basic abbreviation for STEP.

SAVE A widely-used command which causes a program, resident in the memory, to be copied on to a cassette, or in some cases on to disc.

SCRN A special function used on the Apple II which returns a value identifying the colour of a specified graphics block.

SET The statement used in TRS-80 Microsoft Basic which turns on a graphics block specified by its arguments.

SGN A logical function which returns –1,0 or +1 depending respectively on the argument being negative, zero or positive.

SIN An ANSI standard function which returns the sine of its argument. The argument should usually be started in radians.

SLEEP A statement used to cause the suspension of program execution for the number of tenths of a second specified by the argument.

SPACE A function used to print a number of spaces in an output. The number being specified by the argument. Sometimes a $ is appended to this word.

SPC Similar function to SPACE. In the case of the BBC Micro the number of spaces inserted is argument module 256.

SQR The ANSI standard word for the function which returns the square root of a positive number.

SQRT The same as SQR.

ST An abbreviation for the STEP function.

ST. The TRS-80 level 1 abbreviation for STOP.

STEP A standard ANSI word used as part of a FOR . . TO . . STEP function which indicates the size of the increment by its argument which can usually be positive, negative, or non-integer.

STO An abbreviation for STOP.

STOP A statement which halts the execution of a program and puts the computer in the ready mode. A standard ANSI word.

STR$ A useful function which converts a numerical value into its string equivalent.

STRING$ A function which prints a ASCII character a specific number of times. The character code and the number of repeats being the arguments. In some computers the actual character, in quotes, can be the argument.

STUFF A statement used on Opus 1 and 2 machines to place integer values between 0 and 256 in specified memory addresses.

SYS An abbreviation for SYSTEM.

SYSTEM A command and a statement which places the computer into the monitor mode to handle machine-language programs directly.

T

T. This abbreviation is used in TRS-80 level 1 Basic to mean both THEN or TAB. The interpreter recognises the TAB meaning if it is followed by a numeral in parenthesis. For example,

```
      T.(10)
means
      TAB 10
and
      T.10
means
      THEN 10
```

TAB A standard ANSI word which is used in conjunction with PRINT statements. it causes the cursor, or printer carriage, to move to a position corresponding to the number used as an argument from the left-hand edge of the line. ■

RESPONSE FRAME

Do you have a problem? Your manual is incomprehensible or you just cannot get the hang of that programming trick you tried — whatever it is, Tim Hartnell will do his best to answer your queries. Please include only one question per letter and mark them "Response Frame".

SPLIT SCREEN

I wish to write a program on my Spectrum, part of which involves scrolling the top half of the screen up and down, and the top left-hand and right-hand quarters of the screen to left and right individually. Please could you explain how this could be done?

Peter Rutty, Luton, Bedfordshire.

THE EASIEST WAY to do this is to hold the contents of each segment of the screen in a long string. You then print the string in segments, using Print At. For example, to print the left-hand corner, you could use a sequence such as:

```
PRINT AT 0,0; A$( TO 7);AT 1,0; A$(8 TO 16); AT 2,0; A$ (17 TO 25)
```

and so on.

SOLDER JOY

Following the article in *Your Computer* on converting Atari joysticks for use on a Sinclair ZX-81, I would like to know if machine-code programs which use the arrow keys for movement will automatically run using the joystick. Also, is it worth the trouble of soldering the chips, or would I be better off buying a ready-made Sinclair joystick?

S Ray, Ipswich, Suffolk.

UNFORTUNATELY, machine programs using the cursor keys will not automatically run using joystick. Programs have to be tailored very carefully to the actual joystick used. Whether or not is it worth making conversions for yourself, for joysticks or other peripherals, depends largely on your confidence in working with electrical components. If you have any doubts, I would suggest you would be better off buying a unit ready-made.

MOD TROUBLE

I have come across a program in a book which uses the Mod command. Could you tell me how to make this program run on my computer, which does not have Mod?

Martin James, Notting Hill, London W11.

DAVID LIEN'S *Basic Handbook*, published by Compusoft, California, points out that the Mod command which prints the remainder of a division — Print 23 Mod 4 will give 3, the remainder when 23 is divided by 4 — can be emulated as follows. The form of the command generally is X Mod Y. To make A equal to X Mod Y, when your computer does not have Mod, include the line

```
A = INT(Y*(X/Y)) + .001
```

You will find that Lien's book is an invaluable aid when trying to convert programs from foreign Basics into the dialect used by your own computer.

CAT PEOPLE

I have been the proud owner of a large ginger cat for over four months. I realise the limitations of my cat, but I was wondering if you could help me with one particular problem. I also own a ZX-81 which has been damaged by my ginger cat, who pushed it off the edge of the table. The computer will now no longer load programs which I once taped, and if I try to save programs, there is a fluctuating whistle with a very much reduced program signal. I would be very grateful if you could tell me what the fault is, and how it can be corrected.

F Floor, Hampton, Middlesex.

I MUST admit I was not sure what you were going to ask when you started talking about your, cat, but once you mentioned the computer being knocked to the floor I realised the letter was not a joke, as I had at first feared. Despite all that, I am afraid I can not help you. Diagnosis of hardware faults by letter is a notoriously thankless task. I am afraid you will have to send your computer back to Sinclair Research for repair. It is very unlikely that Sinclair will also be able to do something about your cat.

PERICLES RULES

I am waiting delivery of my BBC model A. In the meantime, I am writing some programs for it. I would be pleased if you could tell me if the following statement, in immediate mode,

```
MODE 7, PRINT CHR$ (130);"PERICLES";CHR$(132); "PERICLES"
```

will print the name in two different colours? That is, is it possible to have more than one foreground colour in the same line?

P J Isahageas, Attica, Greece.

THERE IS NO restriction on the use of different foreground colours on a single line mode 7 on the BBC computer, except for the fact that each colour control character — that is, the CHR$(130) or whatever — takes up a single space, so a blank appears every time there is a control character. If blanks do not bother you, you could have the different letters of your name chosen randomly. The following program would do this.

```
10 GOSUB 100
20 PRINT"P";:GOSUB 100
30 PRINT"E";:GOSUB 100
90 GOTO 10
100 PRINT CHR$(128 + RND(6));
110 RETURN
```

TIME BOMB

Recently I acquired a copy of a certain program from a friend. When I list the program, there is a line 6411 in between lines 877 and 1010. It reads

```
6411 cursor STRUCTIONS
```

in inverse. When I run the program, and try and input something, I obtain error code C/6411. I wonder if you could tell me why this happens — it runs on my friend's computer.

Stephen Richards, Billingshurst, West Sussex.

IN THE FIRST place, copying commercial software is robbing the programmer of his or her royalties, so I am afraid I can have little sympathy for you if you have copied a program which your friend bought. It is quite possible that the company which made the software has set a time bomb such as you describe to stop illegal copies from running. The way to remove the odd line is to Poke the exact address where the line is held. Determining such an address is not easy to do. If the program you are copying is not a commercial program, it seems that either your computer has corrupted the program, or it was corrupted by your friend's computer when Saving it. Sometimes an electrical discharge, like an electrical appliance starting up in the house during the Saving process, can put a corrupting "blip" on the program, producing similar results to those you describe.

KEY FEELINGS

I am considering buying an Atari 400 computer because of the vast amount of software available for it. I was wondering if you could tell me of an easy way to put a real keyboard on the Atari when I receive it.

Andrew Know, Edinburgh.

FIRST, I WOULD suggest you do not judge the Atari 400 keyboard too harshly until you have tried it. After the frustration of working on membrane keyboards like the ZX-81, you could be forgiven for believeing the Atari 400 would also be annoying to program, but you may not find it so. I find the 400 a pleasant computer to work with, because the keys have little raised edges, which make for a much more positive feel than the smooth membrane keyboards like the ZX-81. As well as this, the keyboard gives a positive bleep every time you hit a key, and this audio feedback makes typing easy. There is at least one company selling add-on keyboards for the 400, but I would work with the computer before deciding that one of these is vital.

THE STORK TEST

Is there any way of checking that my Sinclair Spectrum 48K is, in fact, a 48K model? There seems to be no external distinguishing feature to identify the two different models.

C Browning, Hampton, Middlesex.

IF YOU LOOK through the hole in the back of the computer, where the Printer plugs in, you will see a number of circular brown objects on a 48K model. These are not present on the 16K version. If you enter

```
DIM A$(40,000)
```

as a direct command on your computer, and you obtain an out-of-memory report code, you have a 16K machine.

SHOP AROUND

As a new reader, in need of some advice, I wish to buy a home computer, mainly for good quality education and games program. I am contemplating buying a Dragon 32, as it seems to have some good specification at a budget price. Could you tell me if I would be restricted to buying only the software supplied by the manufacturer of the computer? I am very keen to buy some Acornsoft items, such as Snapper, Monsters and Defender, and I need to know whether or not these would be compatible. Also, would I need to buy any accessories, such as a tape unit extended RAM, or whatever?

P Wilson, Lancaster Road, London W11.

ALTHOUGH YOU are not restricted to software produced by the manufacturer or distributor of the particular computer you buy, you are restricted to software which is written for the computer which you have bought. Acorn software, whether for the Atom or the BBC Microcomputer, will not run on the Dragon. If you like this software so much, it may be well worth considering buying an Acorn computer. Unless you buy a disc unit for your computer — and many of the cheaper computers do not, as a rule, support discs — you will have to obtain a cassette tape player to be able to load software into your computer. Exceptions to this include the Texas TI-99/4A which accepts plug-in cartridges for programs. You cannot, however, save your own programs on to cartridges. A tape or disc unit is needed for this. ■

ZX81 AND SPECTRUM HARDWARE

ZX81 KEYBOARD

FULLY BUILT!

£28.95

- Full size keyboard
- Plug in — No soldering
- Full Repeat on all keys
- Single keys for RUBOUT, EDIT, FUNCTION and CURSORS
- Large space and newline keys
- 2 Shift keys.

We also are stockist for Redditch Electronics. See their Ad in this issue and Feb 83 page 86. Our prices are 10% less for all their products.

Metal case to hold our keyboard, RAM pack, ZX81, PSU and strong enough to put TV on top. £26.

Postage 40p under £4. Export (surface) £2. Send SAE or 20p for catalogue. Cash with order or ACCESS.

HARRIS & LOCKYER ASSOCIATES
33 Pedmore Close, Woodrow South, Redditch, Worcs B97 7XB

OAKLEAF COMPUTERS LTD

Education Hobbyist & Small Business Computers

BBC

Model B	£399.00*
100K Single Disk	£265.00*
100K Twin Disk	£389.00*

OAKTREE WORKSTATION
Teak £24.95 white £22.95
ELECTRON — PHONE FOR DETAIL

Acorn Atom & BBC Twin User Joystick Interfaces £13.95
(Free Carriage — Please state model)

All Prices include V.A.T. *£8.00 Carriage

BBC SOFTWARE & ASSESSORIES

ALL IN STOCK

NETWORKING & EDUCATION SPECIALISTS

Please send your remittance to:— 121 DUDLEY ROAD, GRANTHAM, LINCS NG31 9AD Tel: (0476) 76994.

ACORN SPECIALISTS

TRANSFORM LTD.

ZX Business Software.

FOR SMALL BUSINESSES AND THE SELF EMPLOYED

Business Bank Account: this program enables you to make debits under 11 subheadings. Statements include totals of all subheadings. £8.75

Sales Day Book: for all your invoices, this program will enable you to prepare statements of outstanding invoices. Program will also calculate VAT. £8.75

Purchase Day Book: keeps a complete record of all your purchases under 11 subheadings. The program will also calculate and deduct VAT. £8.75

Quarterly Analysis: quarterly totals from Bank Account, Purchase and Sales programs can be analysed with this program. £4.75

All the programs have full search facilities and will enable you to prepare quarterly accounts for your VAT returns and annual accounts for your accountant. These programs can also be used by companies not reg. for VAT.

Business Pack: incl. Bank Account, Sales and Purchase programs. £25

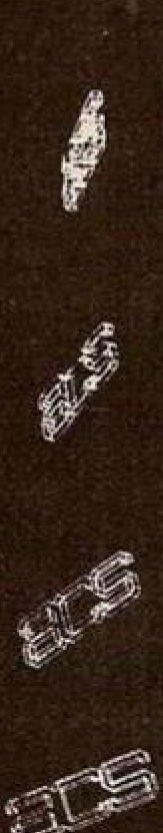
Please specify memory size when ordering for your ZX81 and ZX Spectrum.

All prices include VAT, Post & Packaging. For details send S.A.E. to:

TRANSFORM LTD.,
41 Keats Ho., Porchester Mead, Beckenham, Kent.
Tel: 01-658 1661

VIEWPOINT

THE PROGRAM THAT YOUR ZX SPECTRUM HAS BEEN WAITING FOR!



Draw complex 3-dimensional objects. View them after rotation in any or all of 3 dimensions.
Features:

1) Rotation in 3 dimensions about a single point.
2) Rotation about a line between two points.
3) Generation of stereo pairs.
4) View from one point towards another point.

Objects can be stored separately on tape and copied to the ZX printer.
Written in BASIC for you to modify to your own requirements.
Ideal for computer modelling, molecular modelling, CAD etc.

Viewpoint - with full instruction and examples
£6.50

Just starting to write machine code programs? The ideal assembler for beginners is Ultraviolet. Look at the facilities that it offers:

Works entirely in decimal (no hex problems); all Z80 instructions correctly assembled; supports the pseudo-instructions EQU, ORG (multiple ORGs allowed), DEFB, DEFW and DEFS; code can be assembled at one location and then relocated; allows alphanumeric labels of any length; full listings of assembled code and mnemonics can be output to the printer; full error trapping with faulty instruction clearly indicated; comments can be included in the source file.

The ideal complement to Ultraviolet is Infrared - an easy-to-use disassembler.

So now there is no need to be intimidated by machine code - with Ultraviolet and Infrared it's child's play! Buy them from the machine code specialists - ACS Software.

ULTRAVIOLET - £7.50 **INFRARED - £6.75**

All our Spectrum programs will work in both 16K and 48K models. Please send sae for details of ZX81 programs.

ACS SOFTWARE 7, Lidgett Crescent, Roundhay, Leeds LS8 1HN

Fingertips is our regular calculator column covering calculator news, programming hints and examples of unusual applications. The column is written and compiled by calculator enthusiast David Pringle who is glad to hear of any of your ideas. *Your Computer* pays £6 for each of your contributions published.

THE FIRST program this month comes from Albert Ball of Warrington, for his CBM PR-100. The program performs the basics of Boolean Algebra and is intriguing in being the first calculator program I have seen to do this. Boolean algebra refers to the logical combination of binary codes and can be used in some up-market calculators. Applications of the work are seen not only in computing but digital electronics.

The following sequences can be used to evaluate logical expressions. The two logical values are assumed stored in M1 and M2 but any memories can of course be used.

AND MR 1 X MR 2 = — 6 steps

OR MR 1 + MR 2 = x F INT — 9 steps

INVERT MR 1 +/- + 1 = — 6 steps

EXCLUSIVE OR MR 1 + MR 2 ÷ 2 x F FRAC 2 = — 12 steps

These sequences can be chained together to compute results for more complex expressions. For example, the expression (A.B) + (C.D) gives the following sequence:

(A in M0, B in M1, C in M2 and D in M3) MR 0 x (MR 1 + /- + 1) + ((MR 2 + /- + 1 x MR 3) + /- + 1) = √x F INT R/S.

A further program is useful for pre-setting memory contents prior to evaluating expressions when establishing truth tables. Memory contents can be set manually, of course, but this becomes tedious if many variables are involved, or if many states have to be analysed as for truth tables.

A decimal number is entered manually and the program runs as many times as there are memories to be set. The effect is to load the memories to be set, in other words load the memories with binary digits corresponding to the decimal number entered. The most significant digit is in M0, the next in M1 and so on for as many digits as are needed — up to a maximum of nine.

For example, to generate a truth table for the expression quoted earlier, enter the program shown in locations 0-21 inclusive, and enter the key sequence also shown earlier from location 22 onwards.

Enter 0 — the first decimal number, Goto 00 then press R/S four times — allowing the program to stop between presses. This loads M0 to M3 inclusive with zeros. Run the expression evaluation program from 22, and the result is given. For the next value, enter 1, Goto 00 again press R/S four times. Now M0 to M2 contain zeros and M3 contains 1. Run from 22 for the next result, continuing in this way up to decimal number 15 generates a truth table.

DEC NO.	A (M0)	B (M1)	C (M2)	D (M3)	RESULT
0	0	0	0	0	1
1	0	0	0	1	0
2	0	0	1	0	1
3	0	0	1	1	1
4	0	1	0	0	1
5	0	1	0	1	0
6	0	1	1	0	1
7	0	1	1	1	1
8	1	0	0	0	1
9	1	0	0	1	1
10	1	0	1	0	1
11	1	0	1	1	1
12	1	1	0	0	1
13	1	1	0	1	0
14	1	1	1	0	1
15	1	1	1	1	1

The memory loading sequence shown uses a feature of the CBM PR-100 which is not described in the manual, that is

F x<> M F 9M

This has the effect of cycling the contents of all memories. M0 contents go to M1, M1 to M2 and so on, M9 contents go into the x register — the display — and the x register contents go into M0.

Memory Loading Program.

	0-	1-	2-
-0	÷	M	0
-1	2	0	0
-2	=	R/S	
-3	M	F	
-4	9	X<>M	
-5	F	F	
-6	FRAC	9M	
-7	x	F	
-8	2	INT	
-9	=	GOTO	

Area by co-ordinates program for the TI-57.

LRN					
STO 0	00	32 0	GOTO1	25	51 1
0	01	00	2nd LBC 2	26	86 2
R/S	02	81	RCL 0	27	33 0
STO 1	03	32 1	INV SUM 3	28	-34 3
STO 2	04	32 2	RCL 6	29	33 6
0	05	00	INV SUM 2	30	-34 2
R/S	06	81	RCL 2	31	33 2
STO 3	07	32 3	2ND SUM 3	32	39 3
0	08	00	RCL 3	33	33 3
R/S	09	81	SUM 7	34	34 7
STO 4	10	32 4	INV SBR	35	-61
2ND LBC 1	11	86 1	LBC 4	36	86 4
0	12	00	RCL 1	37	33 1
R/S	13	81	STO 6	38	32 6
STO 5	14	32 5	SBR 2	39	61 2
0	15	00	2	40	02
R/S	16	81	2ND INV SUM 7	41	-39 7
STO 6	17	32 6	0	42	00
SBR 2	18	61 2	X<>T	43	22
RCL 4	19	33 4	2ND 1X1	44	40
STO 2	20	32 2	R/S	45	81
RCL 5	21	33 5	RST	46	71
STO 3	22	32 3		47	
RCL 6	23	33 6		48	
STO 4	24	32 4		49	

Bent Bollerup, of Denmark, has a Jackpot program for the PC-1211 that has kept his friends occupied for hours, he says.

In Def mode you press Shift A. You are asked for an initial number between 0 and 7 — up to ten digits. Enter this, and you are shown the wheels one by one, then the winnings and your total. On pressing Enter you are asked for Hold? (0-1).

010 ENTER

means hold the middle wheel. If you do not want to hold, just press Enter again and the next game is in play.

You will not be asked for Hold after winning. Hold cannot be used in two succeeding plays. Every game costs you two coins — H in line 20 — and you can win from two to 40 coins — G in line 60.

The priority of the signs is from the lowest:

/ - + * = // Y $

If you want to proceed from the last game, rather than from scratch, start on Shift B next time you turn the computer on. About the program: line 5 and sub-routine lines 190-220 generate the first random number. The random generator — lines 200-220 — is to be found in *Response Frame*, March 1982.

Lines 22 to 55 calculate the next random numbers, pick the corresponding sign, and show the wheels. Line 60 calculates the winnings — this can be adjusted by changing the fraction 8/7. Lines 70 and 90 beep 1 for every two coins you win and print the three wheels, your winnings and your total number of coins, plus or minus. Lines 100 to 170 handle the Hold function together with lines 250 and 260 and, to be specific, lines 24 and 26.

For space in the listing I have used a dot. Two dots mean two spaces.

Jackpot program for PC-1211

```
5 "A" H=0: GOSUB 190
10 "B" A$=".": B$=".": C$=".":
   W=0
20 "C" H=H-2
22 FOR X=1 TO 3
24 IF A$(X)="." GOTO 28
26 GOTO 56
28 GOSUB 200
30 A(X+11) J
35 GOTO (J+41)
41 A$ (X)="/" GOTO 50
42 A$ (X)="-" GOTO 50
43 A$ (X)="+" GOTO 50
44 A$ (X)="*" GOTO 50
45 A$ (X)="=" GOTO 50
46 A$ (X)="# GOTO 50
47 A$ (X)="Y" GOTO 50
48 A$ (X)="$" GOTO 50
50 PAUSE "....": A$; B$; C$
55 NEXT X
60 G=INT((L=M)*(M=N)*
   (6+M*2)+((L=M)+(M=N))*
   (2+M*8/7))
70 H=H+G: BEEP G/2
90 PRINT "....": A$; B$; C$; "...";
   G; "..TOT..": H
100 IF W<>0 LET W=0: GOTO "B"
110 IF G GOTO "B"
115 K=0
120 INPUT"..HOLD.?.(0-1).": K
125 W=K: IF K=0 GOTO "B"
130 FOR X=3 TO 1 STEP -1
140 GOSUB 250
150 IF P=0 LET A$(X)="."
```

(continued on next page)

(continued from previous page)

```
160 NEXT X
170 GOTO "C"
190 INPUT "INIT..NUMBER.
    (0.TO.1).";P: Z=(P+Z)/2
200 =(Z+π))I5
210 Z=Z-INT Z
220 J=INT(Z*8): RETURN
250 P=K-INT(K/10)*10
260 K=INT(K/10): RETURN
```

Mark Vince of Halesowen has written an intriguing little program which will output exactly the factorial of any number between 1! and 237!. I await the flood of letters informing me of a quicker method. Mark uses a Casio fx-602P.

This program calculates all digits of n! for any n between 1 and 237. The program calculates all digits and displays the first few digits; successive presses of Exe then display blocks of seven digits at a time. When all digits are exhausted the letter E is displayed to signify End. Long execution times must be expected for large values of n.

Finally a program for the TI-57 from B Maddocks of Sheffield. It will calculate the area of any polygonal shape — a great improvement on Simpson's Rule. This program will give the area of any shape or cross-section from the co-ordinates of that shape based on:

$$A = \sum_{i=2}^{N} \frac{(X_1 = X_i)(Y_{(i+1)} - Y_{(i-1)})}{2}$$

when Yn + 1 = ?1

See figure 1.

		DISPLAY
PRESS	RST	0
..	4	4
..	R/S	0
..	3	3
..	R/S	0
..	1	1
..	+/-	-1
..	R/S	0
..	2	2
..	+/-	-2
..	R/S	0
..	3	3
..	+/-	-3
..	R/S	0
..	2	2
..	+/-	-2
..	R/S	0
..	5	5
..	R/S	0
..	SBR 4	33

Mark Vince's factorial program.

```
MODE.67 MODE 2
PO"#!=" MAC+/-MIN00 1 MIN01 MIN3F 7 10  MIN 1F
LBL0 1 MIN 4F OMINF LBL5 OMIN2F
LBL1 1 M+F IND MRF X MR00+/- + MR2F = IND MINF - MR1F=x≥0
GOTO 2 GOTO 3
LBL2 IND MRF - MR1F - INT MIN 2F=xMR1F=IND MINF GOTO 1
LBL3 MRF-MR4F=x OM+4F MR4F-MR3F=x 0 GOTO 4 GOTO 5
LBL4 M+3F ISZ GOTO0 MR3F MIN 00 IND MR00 LOG INT MIN 1F
LBL6 IND MR00  MR1F 10  FRAC IND MIN 00 =  ";#" MR1F 10 x IND
MR00=IND MIN00 1 M-1F MR1F X 0 GOTO 6 6 MIN1F ";" HLT"" DSZ
GOTO6 "E"
```

Figure 1. Area by co-ordinates

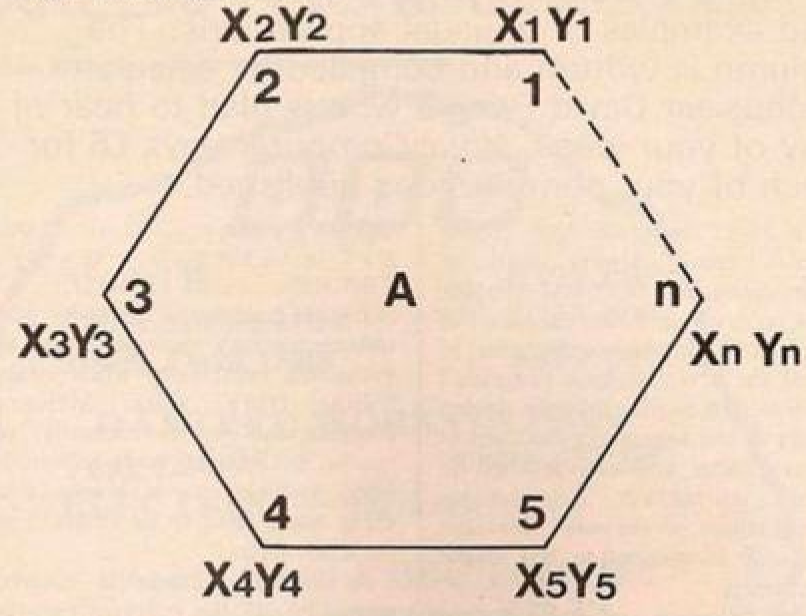
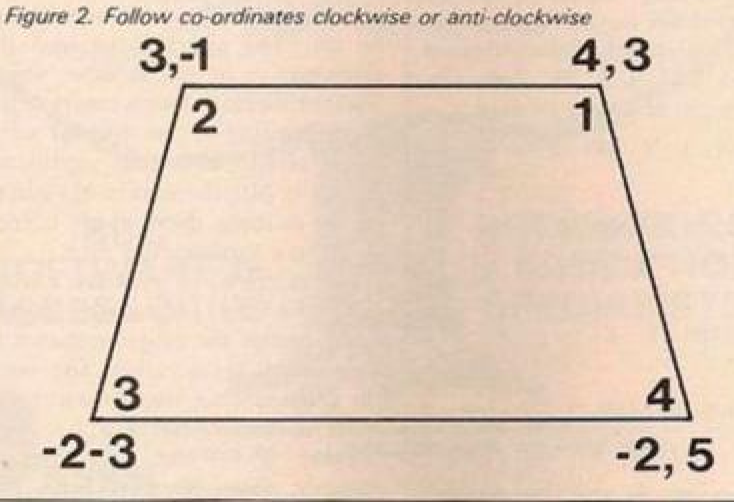


Figure 2. Follow co-ordinates clockwise or anti-clockwise



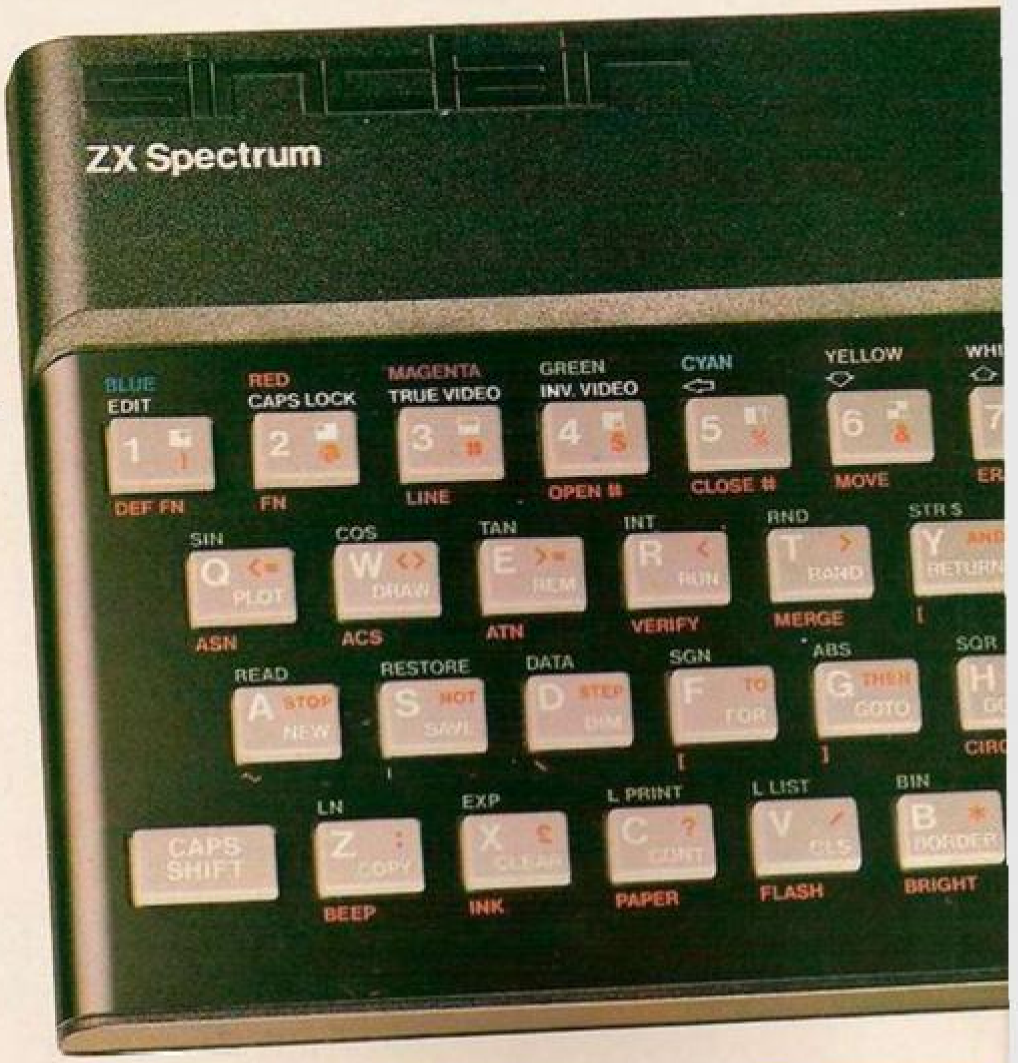


sinclair
ZX Spectrum
BLUE EDIT 1 ! DEF FN
RED CAPS LOCK 2 @ FN
MAGENTA TRUE VIDEO 3 # LINE
GREEN INV. VIDEO 4 $ OPEN #
CYAN 5 % CLOSE #
YELLOW 6 & MOVE
WHITE 7 ' ERASE
8 (POINT
GRAPHICS 9) CAT
BLACK DELETE 0 _ FORMAT
SIN Q PLOT ASN
COS W DRAW ACS
TAN E REM ATN
INT R RUN VERIFY
RND T RAND MERGE
STR$ Y AND RETURN [
CHR$ U OR IF]
CODE I AT INPUT IN
PEEK O ; POKE OUT
TAB P " PRINT ©
READ A STOP NEW ~
RESTORE S NOT SAVE |
DATA D STEP DIM \
SGN F TO FOR {
ABS G THEN GOTO }
SQR H ↑ GOSUB CIRCLE
VAL J - LOAD VAL $
LEN K + LIST SCREEN $
USR L = LET ATTR
ENTER
CAPS SHIFT
LN Z : COPY BEEP
EXP X £ CLEAR INK
LPRINT C ? CONT PAPER
LLIST V / CLS FLASH
BIN B * BORDER BRIGHT
IN KEY$ N , NEXT OVER
PI M . PAUSE INVERSE
SYMBOL SHIFT
BREAK SPACE

Sinclair ZX Spect

16K or 48K RAM... full-size moving-key keyboard... colour and sound... high-resolution graphics...

From only £125!



First, there was the world-beating Sinclair ZX80. The first personal computer for under £100.

Then, the ZX81. With up to 16K RAM available, and the ZX Printer. Giving more power and more flexibility. Together, they've sold over 500,000 so far, to make Sinclair world leaders in personal computing. And the ZX81 remains the ideal low-cost introduction to computing.

Now there's the ZX Spectrum! With up to 48K of RAM. A full-size moving-key keyboard. Vivid colour and sound. High-resolution graphics. And a low price that's unrivalled.

Professional power–personal computer price!

The ZX Spectrum incorporates all the proven features of the ZX81. But its new 16K BASIC ROM dramatically increases your computing power.

You have access to a range of 8 colours for foreground, background and border, together with a sound generator and high-resolution graphics.

You have the facility to support separate data files.

You have a choice of storage capacities (governed by the amount of RAM). 16K of RAM (which you can uprate later to 48K of RAM) or a massive 48K of RAM.

Yet the price of the Spectrum 16K is an amazing £125! Even the popular 48K version costs only £175!

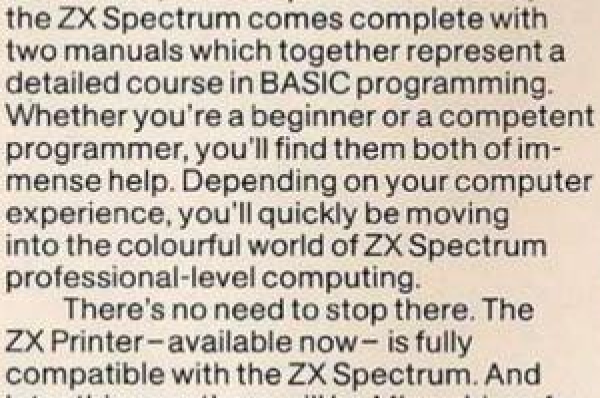
You may decide to begin with the 16K version. If so, you can still return it later for an upgrade. The cost? Around £60.

Ready to use today, easy to expand tomorrow

Your ZX Spectrum comes with a mains adaptor and all the necessary leads to connect to most cassette recorders and TVs (colour or black and white).

Employing Sinclair BASIC (now used in over 500,000 computers worldwide) the ZX Spectrum comes complete with two manuals which together represent a detailed course in BASIC programming. Whether you're a beginner or a competent programmer, you'll find them both of immense help. Depending on your computer experience, you'll quickly be moving into the colourful world of ZX Spectrum professional-level computing.

There's no need to stop there. The ZX Printer–available now–is fully compatible with the ZX Spectrum. And later this year there will be Microdrives for massive amounts of extra on-line storage, plus an RS232/network interface board.



Key features of the Sinclair ZX Spectrum

- Full colour–8 colours each for foreground, background and border, plus flashing and brightness-intensity control.
- Sound–BEEP command with variable pitch and duration.
- Massive RAM–16K or 48K.
- Full-size moving-key keyboard–all keys at normal typewriter pitch, with repeat facility on each key.
- High-resolution–256 dots horizontally x 192 vertically, each individually addressable for true high-resolution graphics.
- ASCII character set–with upper- and lower-case characters.
- Teletext-compatible–user software can generate 40 characters per line or other settings.
- High speed LOAD & SAVE–16K in 100 seconds via cassette, with VERIFY & MERGE for programs and separate data files.
- Sinclair 16K extended BASIC–incorporating unique 'one-touch' keyword entry, syntax check, and report codes.

um



ZX Spectrum software on cassettes–available now

The Spectrum software library is growing every day. Subjects include games, education, and business/household management. Flight Simulation...Chess...Planetoids...History...Inventions...VU-CALC...VU-3D ...Club Record Controller...there is something for everyone. And they all make full use of the Spectrum's colour, sound, and graphics capabilities. You'll receive a detailed catalogue with your Spectrum.

ZX Expansion Module

This module incorporates the three functions of Microdrive controller, local area network, and RS232 interface. Connect it to your Spectrum and you can control up to eight Microdrives, communicate with other computers, and drive a wide range of printers.

The potential is enormous, and the module will be available in the early part of 1983 for around £30.

sinclair

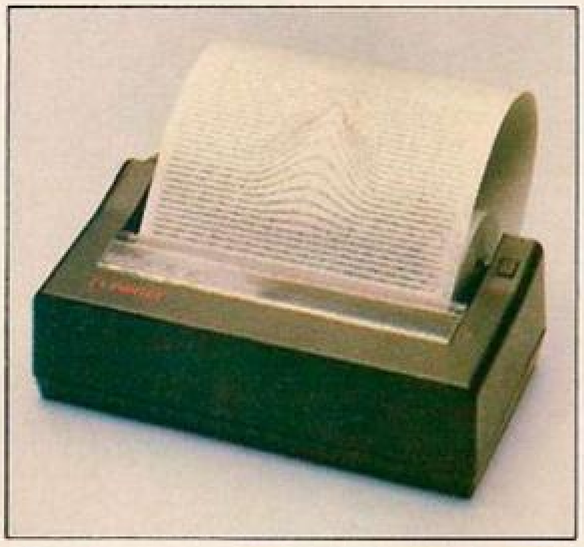
Sinclair Research Ltd, Stanhope Road, Camberley, Surrey GU15 3PS. Tel: Camberley (0276) 685311.

The ZX Printer–available now

Designed exclusively for use with the Sinclair ZX range of computers, the printer offers ZX Spectrum owners the full ASCII character set–including lower-case characters and high-resolution graphics.

A special feature is COPY which prints out exactly what is on the whole TV screen without the need for further instructions. Printing speed is 50 characters per second, with 32 characters per line and 9 lines per vertical inch.

The ZX Printer connects to the rear of your ZX Spectrum. A roll of paper (65ft long and 4in wide) is supplied, along with full instructions. Further supplies of paper are available in packs of five rolls.



The ZX Microdrive–coming soon

The new Microdrives, designed especially for the ZX Spectrum, are set to change the face of personal computing by providing mass on-line storage.

Each Microdrive can hold up to 100K bytes using a single interchangeable storage medium.

The transfer rate is 16K bytes per second, with an average access time of 3.5 seconds. And you'll be able to connect up to 8 Microdrives to your Spectrum via the ZX Expansion Module.

A remarkable breakthrough at a remarkable price. The Microdrives will be available in the early part of 1983 for around £50.



How to order your ZX Spectrum

BY PHONE–Access, Barclaycard or Trustcard holders can call 01-200 0200 for personal attention 24 hours a day, every day. BY FREEPOST–use the no-stamp needed coupon below. You can pay by cheque, postal order, Barclaycard, Access or Trustcard.

EITHER WAY–please allow up to 28 days for delivery. And there's a 14-day money-back option, of course. We want you to be satisfied beyond doubt–and we have no doubt that you will be.

To: Sinclair Research, FREEPOST, Camberley, Surrey, GUI5 3BR. **Order**

Qty	Item	Code	Item Price £	Total £
	Sinclair ZX Spectrum–16K RAM version	100	125.00	
	Sinclair ZX Spectrum–48K RAM version	101	175.00	
	Sinclair ZX Printer	27	59.95	
	Printer paper (pack of 5 rolls)	16	11.95	
	Postage and packing: orders under £100	28	2.95	
	orders over £100	29	4.95	
			Total £	

Please tick if you require a VAT receipt ☐

*I enclose a cheque/postal order payable to Sinclair Research Ltd for £______

*Please charge to my Access/Barclaycard/Trustcard account no.

*Please delete/complete as applicable

Signature

PLEASE PRINT

Name: Mr/Mrs/Miss

Address

YOC 903

FREEPOST–no stamp needed. Prices apply to UK only. Export prices on application.

Sinclair ZX Spectrum–technical data.

Dimensions

Width	233 mm
Depth	144 mm
Height	30 mm

CPU/ memory

Z80A microprocessor running at 3.5 MHz. 16K-byte ROM containing BASIC interpreter and operating system.

16K-byte RAM (plus optional 32K-byte RAM on internal expansion board) or 48K-byte RAM.

Keyboard

40-moving-key keyboard with full upper and lower case with capitals lock feature. All BASIC words obtained by single keys, plus 16 graphics characters, 22 colour control codes, and 21 user-definable graphics characters. All keys have auto repeat.

Display

Memory-mapped display of 256 pixels x 192 pixels; plus one attributes byte per character square, defining one of eight foreground colours, one of eight background colours, normal or extra brightness and flashing or steady. Screen border colour also settable to one of eight colours. Will drive a PAL UHF colour TV set, or black and white set (which will give a scale of grey), on channel 36.

Sound

Internal loudspeaker can be operated over more than 10 octaves (actually 130 semitones) via basic BEEP command. Jack sockets at the rear of computer allow connections to external amplifier/ speaker.

Graphics

Point, line, circle and arc drawing commands in high-resolution graphics.
16 pre-defined graphics characters plus 21 user-definable graphics characters. Also functions to yield character at a given position, attribute at a given position (colours, brightness and flash) and whether a given pixel is set. Text may be written on the screen on 24 lines of 32 characters. Text and graphics may be freely mixed.

Colours

Foreground and background colours, brightness and flashing are set by BASIC INK, PAPER, BRIGHT and FLASH commands. OVER may also be set, which performs an exclusive-or operation to overwrite any printing or plotting that is already on the screen. INVERSE will give inverse video printing. These six commands may be set globally to cover all further PRINT, PLOT, DRAW or CIRCLE commands, or locally within these commands to cover only the results of that command. They may also be set locally to cover text printed by an INPUT statement. Colour-control codes, which may be accessed from the keyboard, may be inserted into text or program listing, and when displayed will override the globally set colours until another control code is encountered. Brightness and flashing codes may be inserted into program or text, similarly. Colour-control codes in a program listing have no effect on its execution. Border colour is set by a BORDER command. The eight colours available are black, blue, red, magenta, green, cyan, yellow and white. All eight colours may be present on the screen at once, with some areas flashing and others steady, and any area may be highlighted extra bright.

Screen

The screen is divided into two sections. The top section – normally the first 22 lines – displays the program listing or the results of program or command execution. The bottom section – normally the last 2 lines – shows the command or program line currently being entered, or the program line currently being edited. It also shows the report messages. Full editing facilities of cursor left, cursor right, insert and delete (with auto-repeat facility) are available over this line. The bottom section will expand to accept a current line of up to 22 lines.

Mathematical operations and functions

Arithmetic operations of +, −, ×, ÷, and raise to a power. Mathematical functions of sine, cosine, tangent and their inverses; natural logs and exponentials; sign function, absolute value function, and integer function; square root function, random number generator, and pi.

Numbers are stored as five bytes of floating point binary – giving a range of $+3 \times 10^{-39}$ to $+7 \times 10^{38}$ accurate to $9\frac{1}{2}$ decimal digits.

Binary numbers may be entered directly with the BIN function. =, >, <, >=, <= and <> may be used to compare string or arithmetic values or variables to yield 0 (false) or 1 (true). Logical operators AND, OR and NOT yield boolean results but will accept 0 (false) and any number (true).

User-definable functions are defined using DEF FN, and called using FN. They may take up to 26 numeric and 26 string arguments, and may yield string or numeric results.

There is a full DATA mechanism, using the commands READ, DATA and RESTORE.

A real-time clock is obtainable.

String operations and functions

Strings can be concatenated with +. String variables or values may be compared with =, >, <, >=, <=, <> to give boolean results. String functions are VAL, VAL$, STR$ and LEN. CHR$ and CODE convert numbers to characters and vice versa, using the ASCII code.

A very powerful string slicing mechanism exists, using the form a$ (x TO y).

Variable names

Numeric – any string starting with a letter (upper and lower case are not distinguished between, and spaces are ignored).
String – A$ to Z$.
FOR-NEXT loops – A-Z.
Numeric arrays – A-Z.
String arrays – A$ to Z$.

Simple variables and arrays with the same name are allowed and distinguished between.

Arrays

Arrays may be multi-dimensional, with subscripts starting at 1. String arrays, technically character arrays, may have their last subscript omitted, yielding a string.

Expression evaluator

A full expression evaluator is called during program execution whenever an expression, constant or variable is encountered. This allows the use of expressions as arguments to GOTO, GOSUB, etc.

It also operates on commands allowing the ZX Spectrum to operate as a calculator.

Cassette interface

The ZX Spectrum incorporates an advanced cassette interface. A tone leader is recorded before the information to overcome the automatic recording level fluctuations of some tape recorders, and a Schmitt trigger is used to remove noise on playback.

All saved information is started with a header containing information as to its type, title, length and address information. Program, screens, blocks of memory, string and character arrays may all be saved separately.

Programs, blocks of memory and arrays may be verified after saving to confirm successful saving.

Programs and arrays may be merged from tape to combine them with the existing contents of memory. Where two line numbers or variables names coincide, the old one is overwritten.

Programs may be saved with a line number, where execution will start immediately on loading.

The cassette interface runs at 1500 baud, through two 3.5 mm jack plugs.

Expansion port

This has the full data, address and control busses from the Z80A, and is used to interface to the ZX Printer, the RS232 and NET interfaces and the ZX Microdrives.

IN and OUT commands give the I/O port equivalents of PEEK and POKE.

ZX81 compatibility

ZX81 BASIC is essentially a subset of ZX Spectrum BASIC. The differences are as follows.

FAST and SLOW: the ZX Spectrum operates at the speed of the ZX81 in FAST mode with the steady display of SLOW mode, and does not include these commands.

SCROLL: the ZX Spectrum scrolls automatically, asking the operator "scroll?" every time a screen is filled.

UNPLOT: the ZX Spectrum can unplot a pixel using PLOT OVER, and thus achieves unplot.

Character set: the ZX Spectrum uses the ASCII character set, as opposed to the ZX81 non-standard set.

ZX81 programs may be typed into the ZX Spectrum with very little change, but may of course now be considerably improved. The ZX Spectrum is fully compatible with the ZX Printer, which can now print out a full upper and lower case character set, and the high resolution graphics; using LLIST, LPRINT and COPY. ZX81 software cassettes and the ZX 16K RAM pack will not operate with the ZX Spectrum.

sinclair
ZX Spectrum

Sinclair Research Ltd, Stanhope Road, Camberley, Surrey, GU15 3PS. Tel: Camberley (0276) 685311.

SOFTWARE FILE

Software File gives you the opportunity to have your programs, ideas and discoveries published. We will accept contributions for any home computer provided they are submitted to *Your Computer* exclusively. Please double-check your programs and specify the memory they require before sending them, preferably on cassette. We pay between £6 and £36 for contributions published.

Turbo

David Green,
Ashford,
Kent.

ZX-81

HERE IS A machine-code arcade-type game written for the 16K ZX-81. It will not work on a computer will less than 3.5K as the down-scroll routine, adapted from Munir Zaman's program in the January 1983 *Your Computer*, crashes if used with a minimum display file. The game itself is relatively simple involving the player controlling a car driving along a road avoiding the edges of the road and any other cars, but the incredible speed of machine code makes it enjoyable and challenging.

To enter the program, first type in a Rem statement containing 305 characters, made up of nine full lines plus 17, as the first line of the program. If you then use the direct command Poke 16510,0. This will give the first line a line number of 0, so that you cannot accidentally erase it. Next type in and run this now well-known hexadecimal loader:

```
1 REM . . .305 characters. . .
10 LET X = 16524
20 LET A$ = ""
30 IF A$ = A"" THEN INPUT A$
40 SCROLL
50 PRINT X,A$(TO 2)
60 POKE X,16*CODE A$ + CODE A$(2)-476
70 LET X = X + 1
80 LET A$ = A$(3 TO)
90 GOTO 30
```

Notice that the actual program in machine code starts at 16524, the first 10 bytes being data.

Enter the hexadecimal numbers shown in the machine-code listing: if you do not understand machine code, then these are numbers in base 16 which allow you to represent any number from 0 to 255 in just two digits — see the Sinclair manual. This loader allows you to enter as many codes as you like before pressing Newline. If you think that you have made a mistake then type S and Newline, and when the error report 3/50 appears then type Let X=an address which you know is correct, followed by Goto 20.

When you have entered the last code C9 at 16818 type S to stop, and then enter the second Basic program which prints the instructions and activates the machine code. Save the resulting program on tape as any error in the machine code could cause a system crash and the loss of your program.

Turbo: machine-code listing

16524:	*16604:*	7E	ED 4B 84 40
01 0B 00	2A 88 40	FE 00	89
ED 43 84 40	3E EF	C2 9F 41	4F
C5	DB FE	3E 26	CD F5 08
CD F5 08	F5	D7	3E 2D
C1	CB 47	*16686:*	D7
3E 80	20 07	ED 4B 84 40	*16757:*
D7	25	0C	2A 86 40
AF	7C	3A 34 40	ED 5B 88 40
D7	FE 00	CB 47	5A
D7	20 01	28 02	16 00
D7	24	0D	2B
D7	F1	0D	7C
D7	CB 4F	79	B5
3E 80	20 07	FE FF	CA AF 41
D7	24	20 01	1B
04	7C	0C	7A
78	FE 15	FE 1A	B3
FE 16	20 01	20 01	20 F5
20 E9	25	0D	22 86 40
21 0E 15	22 88 40	ED 43 84 40	*16781:*
22 82 40	*16638:*	CD F5 08	2A 88 40
21 00 05	2A 0C 40	3E 80	2B
22 86 40	01 B4 02	D7	7C
21 00 14	09	AF	B5
22 88 40	E5	D7	20 FB
21 00 00	01 21 00	D7	2A 8A 40
22 8A 40	09	D7	23
16578:	EB	D7	22 8A 40
ED 4B 82 40	E1	D7	C3 C2 40

3E F7	01 B5 02	3E 80	*16799:*
DB FE	ED B8	D7	01 00 40
CB 67	2A 0C 40	*16730:*	36 3D
20 01	06 20	3A 34 40	0B
0D	AF	E6 07	78
3E EF	23	FE 07	36 BD
DB FE	77	20 12	B1
CB 57	10 FC	3A 35 40	20 F7
20 01	ED 4B 82 40	E6 03	01 FF FF
0C	CD F5 08	3C	C9
ED 43 82 40	2A 0E 40		*16815:*
			01 00 00
			C9
			end 16818

Turbo: Basic listing

```
0 REM . . .(machine code). . .
10 CLS
20 PRINT TAB 10;"TURBO";TAB 10;
   "▀▀▀▀▀"
30 PRINT TAB 8;"(C)D.GREEN"
40 PRINT
50 PRINT "YOU HAVE TO DRIVE YOUR
          CAR ALONG THE ROAD AS FAR
          AS POSSIBLE IN A LIMITED
          AMOUNT OF TIME, AVOIDING
          THE ROADSIDES AND ANY
          OTHER CARS THAT YOU MAY
          COME ACROSS."
60 PRINT
70 PRINT "THE FASTER YOU GO, THE
          GREATER THE DISTANCE THAT
          YOU CAN TRAVEL IN THE TIME."
80 PRINT
90 PRINT "CONTROLS ARE:"
100 PRINT "(5)-MOVE LEFT", "(8)-MOVE
    RIGHT", "(0)-ACCELERATE",
    "(9)-DECELERATE"
110 FOR N = 1 TO 200
120 NEXT N
130 PRINT AT 20,2;
    " PRESS ANY KEY TO START "
    (inverse video)
140 PRINT AT 20,2;"PRESS ANY KEY TO
    START"
150 IF INKEY$ = "" THEN GOTO 130
160 CLS
170 LET X = USR 16524
180 IF X THEN PRINT AT 1,8;"YOU HAVE
    CRASHED"
190 IF NOT X THEN PRINT AT 1,12;"TIME
    UP"
200 PRINT AT 3,12;"SCORE:";PEEK
    16522 + 256*PEEK 16523
210 IF INKEY$<>"" THEN GOTO 210
220 IF INKEY$ = "" THEN GOTO 220
230 GOTO 160
240 SAVE "TURBO"
250 RUN
```

Corridors of fear

Colin Carruthers,
Edinburgh.

SPECTRUM

THE THREE-DIMENSIONAL view that confronts you when you play this game shows the corridors within a maze from which you must escape within a given time. Your current x-y co-ordinate is displayed along with your orientation and the x-y co-ordinate of the way out.

Movement around the maze is by means of the cursor control keys: 7 moves one space forward — unless there is a wall directly in front — and 5 and 8 turn the player through 90° to the left or right.

At the end of the game, a plan of the maze is drawn so the player can see where he took the wrong turning. The game consists of a short machine-code routine and a larger Basic program.

The machine-code routine clears the first 22 columns of the display file and is best entered using the short Basic program. Run it, save it on tape and test the routine by typing

LET x = USR 23760

Assuming all is well, delete lines 10-40 by typing their line numbers. Type in the main program, using:

LIST 2

instead of just List to avoid listing the machine-code. The graphics characters in line 5025 are graphic ABCD and the inverse characters in 5786 say "Hit any key to being".

Each maze used in random, generated from four out of eight possible segments, each five by five units giving a final maze of 10 by 10 units.

```
   1 REM aaaaaaaaaaaaaaaaaaaaaaa
aaaaaaaaa
  10 DATA 6,192,17,10,0,33,0,64,
197,6,22,54,0,35,16,251,237,90,1
93,16,243,201
  20 FOR x=23760 TO 23781
  30 READ v: POKE x,v
  40 NEXT x
   5 RANDOMIZE : BORDER 0: PAPER
 0: INK 7
  10 CLS : PRINT AT 5,7;"M A Z E
";AT 10,2;"© Colin Carruthers";A
T 12,8;"1982"
  20 GO SUB 5000
  45 GO SUB 3000: PRINT AT 21,23
;d$(f)
  50 GO SUB 1000
  60 LET z$=INKEY$
  61 LET t=INT ((256*PEEK 23673+
PEEK 23672)/50)
  62 INK 0: PLOT 240,time-t+8: D
RAW 7,0: DRAW 0,1: DRAW -7,0: DR
AW 0,1: DRAW 7,0: INK 7
  63 IF t>=time THEN LET q$="TIM
E UP !": FOR e=10 TO -15 STEP -2
: BEEP .2,e: NEXT e: GO TO 7000
  64 IF z$<>"5" AND z$<>"8" AND
z$<>"7" THEN GO TO 60
  65 IF z$="7" THEN LET xp=xp+(x
a AND m$(xp,yp)(f)<>"w")
  66 IF xp>xmax OR xp<1 THEN LET
 q$="FREE !": GO TO 7000
  67 IF z$="7" THEN LET yp=yp+(y
a AND m$(xp,yp)(f)<>"w")
  68 IF yp>ymax OR yp<1 THEN LET
 q$="FREE !": GO TO 7000
  70 IF z$="5" THEN GO SUB 4000
  80 IF z$="8" THEN GO SUB 4100
  85 GO SUB 3000: PRINT AT 21,23
;d$(f)
  90 GO TO 50
1000 LET x=xp: LET y=yp: LET dra
w=2000
1015 GO SUB 3000
1019 LET q=USR 23760: PRINT AT 2
1,9;xp;",";yp
```

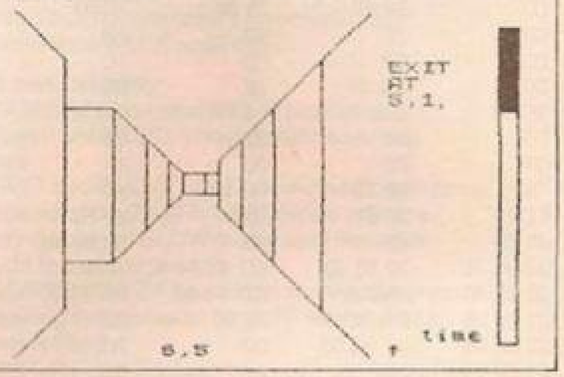
(continued on next page)

(continued from previous page)

```
1020 IF m$(x,y)(l)="w" THEN GO S
UB draw: GO TO 1030
1022 IF m$(x,y)(l)="e" THEN GO T
O 1030
1025 IF m$(x-ya,y+xa)(f)="w" THE
N GO SUB draw+30
1030 IF m$(x,y)(r)="w" THEN GO S
UB draw+10: GO TO 1040
1032 IF m$(x,y)(r)="e" THEN GO T
O 1040
1035 IF m$(x+ya,y-xa)(f)="w" THE
N GO SUB draw+40
1040 IF m$(x,y)(f)="w" THEN GO S
UB draw+20: RETURN
1045 IF m$(x,y)(f)="e" THEN RETU
RN
1050 LET x=x+xa: LET y=y+ya: LET
 draw=draw+100: GO TO 1020
2000 PLOT 0,175: DRAW 24,-24: DR
AW 0,-127: DRAW -24,-24: RETURN
2010 PLOT 175,175: DRAW -24,-24:
 DRAW 0,-127: DRAW 24,-24: RETUR
N
2020 PLOT 24,151: DRAW 127,0
2021 DRAW 0,-127: DRAW -127,0
2022 DRAW 0,127
2025 RETURN
2030 PLOT 0,151: DRAW 24,0: DRAW
 0,-127: DRAW -24,0
2035 RETURN
2040 PLOT 175,151: DRAW -24,0: D
RAW 0,-127: DRAW 24,0: RETURN
2100 PLOT 24,151: DRAW 24,-24: D
RAW 0,-79: DRAW -24,-24
2101 DRAW 0,127: RETURN
2110 PLOT 151,151: DRAW -24,-24:
 DRAW 0,-79: DRAW 24,-24
2111 DRAW 0,127: RETURN
2120 PLOT 48,127: DRAW 79,0: DRA
W 0,-79: DRAW -79,0: DRAW 0,79
2125 RETURN
2130 PLOT 24,127: DRAW 24,0: DRA
W 0,-79: DRAW -24,0: RETURN
2140 PLOT 151,127: DRAW -24,0: D
RAW 0,-79: DRAW 24,0: RETURN
2200 PLOT 48,127: DRAW 16,-16: D
RAW 0,-47: DRAW -16,-16: DRAW 0,
79: RETURN
2210 PLOT 127,127: DRAW -16,-16:
 DRAW 0,-47: DRAW 16,-16: DRAW 0
,79: RETURN
2220 PLOT 64,111: DRAW 47,0
2221 DRAW 0,-47: DRAW -47,0: DRA
W 0,47
2225 RETURN
2230 PLOT 48,111: DRAW 16,0: DRA
W 0,-47: DRAW -16,0
2231 RETURN
2240 PLOT 127,111: DRAW -16,0: D
RAW 0,-47: DRAW 16,0
2241 RETURN
2300 PLOT 64,111: DRAW 11,-11: D
RAW 0,-25: DRAW -11,-11: DRAW 0,
47: RETURN
2310 PLOT 111,111: DRAW -11,-11:
 DRAW 0,-25: DRAW 11,-11: DRAW 0
,47: RETURN
2320 PLOT 75,100: DRAW 25,0: DRA
W 0,-25: DRAW -25,0: DRAW 0,25
2325 RETURN
2330 PLOT 64,100: DRAW 11,0: DRA
W 0,-25: DRAW -11,0: RETURN
2340 PLOT 111,100: DRAW -11,0: D
RAW 0,-25: DRAW 11,0: RETURN
2400 PLOT 75,100: DRAW 7,-7: DRA
W 0,-11: DRAW -7,-7: DRAW 0,25:
RETURN
2410 PLOT 100,100: DRAW -7,-7: D
RAW 0,-11: DRAW 7,-7: DRAW 0,25:
 RETURN
2420 PLOT 82,93: DRAW 11,0: DRAW
 0,-11: DRAW -11,0: DRAW 0,11
2421 RETURN
2430 PLOT 75,93: DRAW 7,0: DRAW
0,-11: DRAW -7,0: RETURN
2440 PLOT 100,93: DRAW -7,0: DRA
W 0,-11: DRAW 7,0: RETURN
2500 PLOT 82,93: DRAW 4,-4: DRAW
 0,-3: DRAW -4,-4: DRAW 0,11
2501 RETURN
2510 PLOT 93,93: DRAW -4,-4: DRA
W 0,-3: DRAW 4,-4: DRAW 0,11
2511 RETURN
2520 PLOT 86,89: DRAW 3,0: DRAW
0,-3: DRAW -3,0: DRAW 0,3
2521 RETURN
2530 PLOT 82,89: DRAW 4,0: DRAW
0,-3: DRAW -4,0: RETURN
2540 PLOT 93,89: DRAW -4,0: DRAW
 0,-3: DRAW 4,0: RETURN
3000 IF ya=1 THEN LET f=1: LET l
=2: LET r=3: RETURN
3020 IF ya=-1 THEN LET f=4: LET
l=3: LET r=2: RETURN
3030 IF xa=1 THEN LET f=3: LET l
=1: LET r=4: RETURN
3040 LET f=2: LET l=4: LET r=1:
RETURN
4000 IF ya=-1 THEN LET ya=0: LET
 xa=1: RETURN
4020 IF ya=1 THEN LET ya=0: LET
xa=-1: RETURN
4030 IF xa=1 THEN LET xa=0: LET
ya=1: RETURN
4040 LET xa=0: LET ya=-1: RETURN

4100 IF ya=-1 THEN LET ya=0: LET
 xa=-1: RETURN
4120 IF ya=1 THEN LET ya=0: LET
xa=1: RETURN
4130 IF xa=1 THEN LET xa=0: LET
ya=-1: RETURN
4140 LET xa=0: LET ya=1: RETURN
5000 DIM m$(10,10,4): LET xmax=1
0: LET ymax=10
5005 LET d$="↑<>v"
5010 POKE USR "a",255: POKE USR
"d"+7,255
5015 FOR x=1 TO 7: POKE USR "a"+
x,0: POKE USR "d"+x-1,0: NEXT x
5020 FOR x=0 TO 7: POKE USR "b"+
x,128: POKE USR "c"+x,1: NEXT x
5025 DIM g$(4): LET g$="] L"
5100 PLOT 239,7: DRAW 9,0: DRAW
0,161: DRAW -9,0: DRAW 0,-161
5200 FOR x=20 TO 1 STEP -1: PRIN
T AT x,30; PAPER 4;" ": BEEP .01
,20-x: NEXT x
5205 PRINT AT 20,25;"time"
5300 LET xa=1: LET ya=0
5700 LET ys=10: LET xs=1: LET z=
(RND>.49)*100: RESTORE 8000+z: G
O SUB 5800
5710 LET xs=6: LET z=(RND>.49)*1
00: RESTORE 8200+z: GO SUB 5800
5720 LET ys=5: LET xs=1: LET z=(
RND>.49)*100: RESTORE 8400+z: GO
 SUB 5800
5730 LET xs=6: LET z=(RND>.49)*1
00: RESTORE 8600+z: GO SUB 5800
5735 LET z=RND
5740 LET ye=1*(z<.33)+10*(z>.67)
5745 IF NOT ye THEN LET ye=INT (
RND*10)+1
5750 IF ye=1 OR ye=10 THEN LET x
e=INT (RND*10)+1: GO TO 5770
5760 LET xe=1+(9*(RND>.49))
5770 IF xe=1 THEN LET m$(xe,ye)(
2)="e": GO TO 5780
5772 IF xe=10 THEN LET m$(xe,ye)
(3)="e": GO TO 5780
5774 IF ye=1 THEN LET m$(xe,ye)(
4)="e": GO TO 5780
5776 LET m$(xe,ye)(1)="e"
5785 LET yp=11-ye: LET xp=11-xe
5786 LET sx=xp: LET sy=yp: BEEP
.2,-10: PRINT AT 21,1;"[illegible]
[illegible]": PAUSE 1: PAUSE 0
5789 PRINT AT 3,23;"EXIT";AT 4,2
3;"AT ";AT 5,23;xe;",";ye
5790 LET time=153: LET t=0: POKE
 23674,0: POKE 23673,0: POKE 236
72,0
5795 PRINT AT 1,30; INK 4;"▀"
5799 RETURN
5800 FOR y=ys TO ys-4 STEP -1
5810 READ z$
5820 FOR x=1 TO 5
5830 LET m$(x+xs-1,y)=z$(4*x-3 T
O 4*x)
5840 NEXT x: NEXT y
5850 RETURN
6000 OVER 1
6020 FOR y=ymax TO 1 STEP -1: FO
R x=1 TO xmax: FOR d=1 TO 4
6030 IF m$(x,y)(d)="w" THEN PRIN
T AT 15-y,x+4;g$(d)
6035 NEXT d
6036 IF x=sx AND y=sy THEN PRINT
 AT 15-y,x+4;"+": GO TO 6040
6037 IF x=xp AND y=yp THEN PRINT
 AT 15-y,x+4;d$(f)
6040 NEXT x: NEXT y
6050 OVER 0
6070 RETURN
7000 IF q$(1)="F" THEN BEEP .5,1
0: BEEP .5,15
7005 LET q=USR 23760: PRINT AT 1
8; INVERSE 1;q$
7010 GO SUB 6000
7012 PRINT AT 17,3;"+ = start po
sition"
7015 PAUSE 100: BEEP .2,-7: BEEP
 .4,0
7020 PRINT AT 21,0;"Another Go ?
 (Y/N)"
7030 IF INKEY$="n" OR INKEY$="N"
 THEN STOP
7035 IF INKEY$="y" OR INKEY$="Y"
 THEN RUN
7040 GO TO 7030

8000 DATA "ww  w wwww ww w ww  "
8010 DATA " ww ww ww      w  ww "
8030 DATA " w ww  w  w  w w  w "
8040 DATA "ww  w  w  w ww    ww"
8050 DATA " ww ww w  ww w  w  w"
8100 DATA "www ww ww   w  ww  w"
8110 DATA " w ww w  w ww  ww w "
8120 DATA "ww     wwww  w  w ww"
8130 DATA " w   w w  ww ww ww w "
8140 DATA " ww  w w  ww w  w w"
8200 DATA "w  ww w ww  w  ww ww"
8210 DATA "www  ww  w ww   w w "
8220 DATA " w w   ww w  ww  ww "
8230 DATA "ww  w w  w w  w  ww "
8240 DATA "  w  ww ww w  ww ww "
8300 DATA "w  ww www  w   ww w "
8310 DATA "ww  w       ww ww ww "
8320 DATA " ww  w ww w ww    ww"
8330 DATA " ww www  ww  w ww ww"
8340 DATA "  w  ww  w ww  ww w "
8400 DATA " w ww  ww w  wwwww  "
8410 DATA "ww  w ww w ww w  w  "
8420 DATA " ww ww  w w  w   w  "
8430 DATA " w w  ww ww  ww  www"
8440 DATA "ww ww  w   w   ww  w"
8500 DATA " ww ww ww w  w ww ww"
8510 DATA " ww ww      w ww  w w"
8520 DATA " w w  ww ww  w ww w "
8530 DATA "www ww w   w  w   ww"
8540 DATA " w ww  w   ww  ww  w"
8600 DATA " www w ww   w ww ww "
8610 DATA "w  ww w  ww ww    ww"
8620 DATA "ww w   w  w  ww www "
8630 DATA "ww  w w  w w  ww ww "
8640 DATA "  ww w ww  ww  w  ww"
8700 DATA " w w   ww   w  w  w "
8710 DATA "w   w ww w  w ww www"
8720 DATA " ww www  w  w  ww ww"
8730 DATA " w w       ww  ww w "
8740 DATA "w  w  wwww ww  w  ww"
```



Rocket command

Gareth Rowland,
Stockbridge,
Sheffield.

DRAGON

YOU, A DOT roughly in the screen centre, have to try and protect all four cities at the bottom of the screen from incoming bombs from outer space. Each time one of the bombs hits a city, a dot appears underneath the foremost left city. When all cities have a dot underneath them, the game ends. To protect your cities you are equipped with a device which causes the space-bombs to detonate prematurely. When you move the base and push the fire button an explosion will occur round your base. If a bomb is in the vicinity, it will stop, leaving its smoke trail, and another will appear at the top.

To move your base, a joystick is required. The movement of the base is controlled between lines 340-410. The variables are Score for score, Base for number of bases blown up, x,y and x1,y1 for the bombs and x2,y2 for your base.

The program takes only 1,922 bytes so you can always modify it. Note: if you wish to Save it or Load it, you must first press the reset button.

```
25 IF I>9 OR I<1 THEN RUN
115 DRAW "C8;BM118,255;E10;F10"
550 FOR R = 1 TO I+2
555 LINE (130,150)-(x2,y2),PSET
556 LINE (130,150)-(x2,y2),PRESET
560 CIRCLE (x2,y2),R,7
570 NEXT R
575 IF PPOINT (x,y) = 7 THEN SCORE =
    SCORE + 5.
RENUM.
```

```
10 REM MISSILE COMMAND BY GARETH ROWLAND,8 JAN.
20 CLS2:PRINT@8,"MISSILE COMMAND";:PRINT@40,"***************";
   :PRINT@192,"LEVEL
OF DIFFICULTY(1 TO 10)";:INPUT I
30 FOR D=1 TO 100:SOUND D,1:NEXT D
40 PMODE 3,1:SCREEN 1,1:PCLS
50 BASE=0 : SCORE=35
60 F=33:G=0:T=128:Q=0
70 PCLS
80 LINE(40,150)-(48,154),PSET,BF
90 LINE(81,150) -(89,154),PSET,BF
100 LINE(164,150)-(172,154),PSET,BF
110 LINE(212,150)-(220,154),PSET,BF
120 LINE(1,156)-(249,165),PSET,BF
130 X=RND(251):Y=0
140 X1=RND(251):Y1=0
150 X2=100:Y2=100
160 E=RND (144):A=RND(2)
170 POKE &HFFD7,0
180 Y1=Y1+1:X1=X1-2:Y=Y+1:X=X+1
190 IF SCORE>30 THEN 200 ELSE 220
```

```
200 F=F+1:G=G+3
210 PSET(F,G,6)
220 PSET (X,Y,6):PSET(X1,Y1,6)
230 IF SCORE>60 THEN 240 ELSE260
240 T=T+1:Q=Q+4
250 PSET(T,Q,6)
260 IF Y=151 OR Y1=151 THEN 60
270 IF X1<4 THEN X1=X1 +2
280 IF G=150 THEN BASE=BASE+1
290 IF G=153 THEN 60
300 IF Q=148 THEN BASE=BASE+1
310 IF Q=152 THEN 60
320 IF A=1 THEN X1=X1+2
330 IF A=2 THEN X=X-2
340 J=JOYSTK(0):JJ=JOYSTK(1)
350 PRESET(X2,Y2)
360 P=PEEK(65280)
370 PRESET(F,G):PRESET(T,Q)
380 IFJ<10 THEN X2=X2-3
390 IFJ>50 THEN X2=X2+3
400 IF JJ>50 THEN Y2=Y2+3
410 IF JJ<10 THEN Y2=Y2-3
420 IF Y2=>145 THEN Y2=Y2-3
430 IF X2=<3 THEN X2=X2+3
440 IF X2=3 THEN PSET(X2,Y2,5)
450 IF Y2=145 THEN PSET(X2,Y2,5)
460 IF Y2=<3 THEN Y2=Y2+3
470 IF Y2=3 THEN PSET(X2,Y2,5)
480 PSET(X2,Y2,7)
490 IF BASE>=1 THEN PSET(44,174,7)
500 IF BASE >=2 THEN PSET(85,174,7)
510 IF BASE  >=3 THEN PSET(168,174,7)
520 IF BASE  >=4 THEN PSET(216,174,7)
530 IF BASE=4 THEN GOTO 730
540   IF P=126 THEN 550 ELSE 690
550 FOR R=1 TO I+2
560 CIRCLE (X2,Y2),R,7
570 NEXT R
580 IF PPOINT(X,Y)=7 THEN SOUND 5,10:IF PPOINT (X,Y)=7 THEN Y=0:
IF PPOINT(X,Y)=7 THEN SCORE=SCORE+5
590 IF PPOINT(F,G)=7 OR PPOINT(T,Q)=7 THEN SCORE =SCORE+10
600 IF PPOINT(F,G)=7 OR PPOINT(T,Q)=7 THEN SOUND 15,1
610 IF PPOINT(T,Q)=7 THEN T=128:IF T=128 THEN Q=0
620 IF PPOINT(F,G)=7 THEN F=33: IF F=33 THEN G=0
630 IF PPOINT(X1,Y1)=7 THEN SCORE=SCORE+5
640 IF PPOINT(X1,Y1)=7 THEN SOUND 22,10
650 IF PPOINT (X1,Y1)=7 THEN Y1=0
660 FOR Q= 1 TO I+2
670 CIRCLE(X2,Y2),Q,5
680 NEXT Q
690 IF PPOINT(X,Y)=8 OR PPOINT(X1,Y1)=8 THEN BASE=BASE+1
700 GOTO 160
710 FOR D=1 TO  5:                    C=RND(8)
720 CLSC:SOUND D,3:NEXT D
730 CLS4:PRINT@12,"end of game";
740 PRINT@44,"SCORE=";SCORE;
750 PRINT@290,"ANOTHER(Y OR N)";:INPUT A$
760 IF A$="Y" THEN RUN:END
```

Tank killer

Peter Wales,
Hereford.

VIC-20

USING MULTICOLOUR mode graphics on the unexpanded Vic-20, you can create this bombing game. The objective is to blow up a tank by dropping a bomb from your supersonic jet while avoiding the tank's return of fire. There are 10 skill levels in the game. These determine the rate at which the tank's missiles home in on you and the speed of the tank.

To obtain multicolour graphics for text, Poke 646,12 then use Print. To use this mode for graphics, Poke the colour memory map with 12 for the position of your object. To achieve horizontal bars in the graphics use Poke 36878,16. To turn them off use Poke 36878,0. This is the volume location. This is used to flash the plane and create good graphic explosions in the game.

Main program lines

10 - 80	INITIALISATION
300 - 395	MAIN SUBROUTINE
5000 - 5090	YOUR SHOT ROUTINE
8000 - 8135	YOUR WIN ROUTINE
8140 - 8440	TITLE INSTRUCTIONS
9000 - 9080	ROUTINE TO ANIMATE TANK
9910 - 9970	TANK-SHOOTING ROUTINE
10000 - 10100	YOU LOSE ROUTINE
30000 - 30060	SKILL LEVEL ROUTINE

Main variables

P	= POSITION OF JET
TB	= POSITION OF TANK
M	= POSITION OF BOMB
TM	= POSITION OF MISSILE
SN	= SOUND LOCATION
VN	= VOLUME, GRAPHICS LOCATION
SK	= SKILL LEVEL
G$	= TIME
A$	= KEYBOARD INPUT

To make the game more difficult change line 5075 to:

5075 IF PEEK (H + 22 + I) = 30 THEN 8000

Now you have to hit the tank in the dead centre.

```
3 REM *(C) PETER WALES *
4 REM *   A TWO TONE   *
5 REM *  GRAPHICS GAME *
6 REM ******************
10 PRINT"J#",CHR$(8) POKE36879,14 POKE36878,15 POKE650,255 POKE198,0 HI$="999999
"
20 FORN=8186TO8230 POKEN,32 NEXT VN=36878 SN=36874
30 GOTO8140
40 TI$="000000" POKE646,10 PRINT"J" TB=INT(RND(1)*18)
50 P=7680+40
300 REM
301 POKEVN,FL POKESN,F/35
302 FL=16-FL GETA$
320 IFA$="W"THENP=P-22
330 IFA$="Z"THENP=P+22
333 IFP<7702THENP=P+22
334 IFP>8011THENP=P-22
340 IFA$="P"ANDF=0THENGOSUB5000 GOTO355
341 PRINT"##TIME #";TI$
345 IFF=1THENGOSUB5000
346 GOSUB9000
355 CP=38400+P-7680
356 POKECP,12 POKECP-1,10 POKECP-2,10 POKECP-24,10 POKECP+20,10
360 POKEP,62 POKEP-1,60 POKEP-2,35 POKEP-24,77 POKEP+20,78
390 POKEP-3,32 POKEP-25,32 POKEP+19,32 POKEP+41,32 POKEP-47,32 POKEP+21,32 POKEP
-23,32
```

(continued on next page)

(continued from previous page)

```
391 IFTF=1THENIFPEEK(TM)<>32THEN10000
395 F=F+1:POKEVN,0:GOTO300
5000 IFF=1THEN5030
5010 IFF=0THENF=1:H=P
5030 POKEH,P%:POKEH+30400-7680,12:POKEH-22-I,32:POKEH-23-I,32
5031 H=H-22+I:IFH>7680+350THENP%=22:I=0:GOTO5037
5035 IFH>7680+200THENP%=15:I=.5:GOTO5037
5036 P%=4:I=1
5037 REM
5070 IFH>8186THENF=0:POKEH-22-I,32
5075 IFPEEK(H+1)<>32THEN8000
5090 RETURN
8000 G$=TI$:FORP=1TO12:FORN=1TO14:POKE36879,N:NEXTN,P
8001 POKE646,14:PRINT"XXXXXXXXXXXXXXXXXX";TAB(TB);"••••▮▮▮▮▮••••"
8005 POKEH-22,32
8006 F=0:TF=0
8010 FORN=130TO240:POKESN,N:FORV=20TO0STEP-2:POKEVN,V
8020 NEXTV,N
8030 PRINT"J":POKE646,14
8040 PRINT"WELL DONE "
8050 PRINT"XXIN ";G$;" SECONDS"
8060 FORN=1TO10
8070 POKEVN,19:FORT=1TO150:NEXT
8080 POKEVN,0:FORT=1TO100:NEXT
8090 NEXT
8100 PRINT"XXWELL DONE "
8110 PRINT"XXIN ▮";G$;" ▮SECONDS"
8120 FORT=1TO1000:NEXT
8130 IFG$<HI$THENPRINT"XXTHAT WAS A GOOD RUN":HI$=G$
8135 FORT=1TO2000:NEXT
8140 D$="XXXXXXXXXX"
8141 PRINT"J▮▮    ▮              ▮"
8142 PRINT"    ▮   ▮BOMB RUN▮    ▮"
8143 PRINT"    ▮                 ▮"
8144 PRINT"XX    ▮BEST TIME ▮";HI$:PRINT"X(C) PETER WALES 1982TT"
8145 POKE646,14
8147 F=0:TF=0
8200 PRINT"XXXXXXXXYOU MUST BOMB THE TANK":PRINT"▮USING YOUR SUPER JET."
8210 PRINT"▮YOU MAY ONLY DROP ONE BOMB AT A TIME.":PRINT"XX▮WATCH OUT FOR THE TAN
K";
8220 PRINT"IT SHOOTS TOO!"
8230 PRINT"  XX▮A=UP▮ ▮Z=DOWN▮ ▮P=FIRE▮":POKE646,12
8250 FORA=0TO17
8260 PRINTD$;TAB(A);" \"
8270 PRINTTAB(A);" ▮<>"
8280 PRINTTAB(A);" /"
8290 FORN=1TO100:POKEVN,0:POKEVN,16:GETA$:IFA$=""THENNEXTN:NEXTA
8300 PRINT"J▮";
8400 PRINT"XXX▮WOULD YOU LIKE TO PLAY":PRINT"XXXXXXX▮BOMB RUN"
8405 PRINT"XX   ▮   ▮Y / N ▮"
8410 GETA$:IFA$=""THEN8410
8420 IFA$="Y"ORA$="P"THEN30000
8430 IFA$="N"THENPRINT"JOK BYE.BYE.":END
8435 GOTO8410
8440 END
8999 REM TANK
9000 POKE646,12:PRINT"XXXXXXXXXXXXXXXXXXXXX";TAB(TB);" /T\ ";"▮▮▮▮▮▮ ••• "
9010 TT=P-7680:TB=INT((P-7680)/22):TA=TT-(TB*22)
9015 POKEVN,15:POKESN,128+(4*TB)
9020 IFTB<TATHENTB=TB+SK:TM=TM+SK
9030 IFTB>TATHENTB=TB-SK:TM=TM-SK
9035 POKESN,0
9040 IFTB<0THENTB=18
9050 IFTB>18THENTB=0:PRINT"XXXXXXXXXXXXXXXXXXXXX";TAB(17);"      ▮▮▮▮▮▮    "
9060 IFTF=1THEN9910
9070 IFTF=0ANDRND(1)>.6THEN9910
9080 RETURN
9910 IFTF=0THENTF=1:TM=8100+TB
9915 POKETM,30:POKETM+30720,14
9920 TM=TM-22
9950 IFTM<7702THENTF=0:POKETM+22,32:REMPOKETM-21,32:POKETM-23,32
9960 POKETM+44,32:POKETM+43,32:POKETM+45,32
9970 GOTO9080
10000 FORN=220TO128STEP-2
10005 POKE36879,N-116
10010 POKESN,N
10020 FORV=1TO20:POKEVN,V:NEXT
10030 NEXTN
10040 PRINT"JXXXXXXTOO BAD!"
10050 PRINT"XXXXXXYOU GOT HIT!"
10060 PRINT"XXXXXXXTIME ▮";TI$
10070 POKEVN,0:POKESN,0
10080 PRINT"XXX▮   ▮PRESS A KEY"
10085 POKE198,0
10090 WAIT198,1:GETA$
10100 GOTO8141
30000 PRINT"J▮    ▮ BOMB RUN ▮"
30010 PRINT"XXX   WHAT SKILL LEVEL":PRINT"XXX   (0 TO 10) EASY-HARD"
30030 PRINT"▮▮";:INPUTA
30040 IFA<0ORA>10THEN30000
30045 SK=INT(A)/10
30060 GOTO40
```

Psychic asteroids

J P Riggs,
Gosport,
Hampshire.

BBC

WRITING GAMES on a home computer can pose many problems, the main one being where do I start? You can start designing things like the layout of the screen, special characters and sound effects. If the game is of the type where you are playing the computer the program must contain the logic to handle this. Once the program has been written you will want to improve it by speeding it up and having better presentation and a more exciting game.

In this program the ship can be rotated and the relevant positions must be calculated many times a second to give the effect of the craft spinning, therefore sine and cosine tables are set up before the games commences. Other ways of speeding up are a program to remove any routines which are wasting time, spaces and superfluous text. Simplifying the equations before the computer evaluates them can save a great deal of time.

If you have moving graphics you need them to move smoothly across the screen without disturbing features such as the scores and visual information. This can be achieved on the BBC by setting up separate graphics and text windows, using VDU24 for graphics window and VDU28 for text windows — see page 386 of the manual.

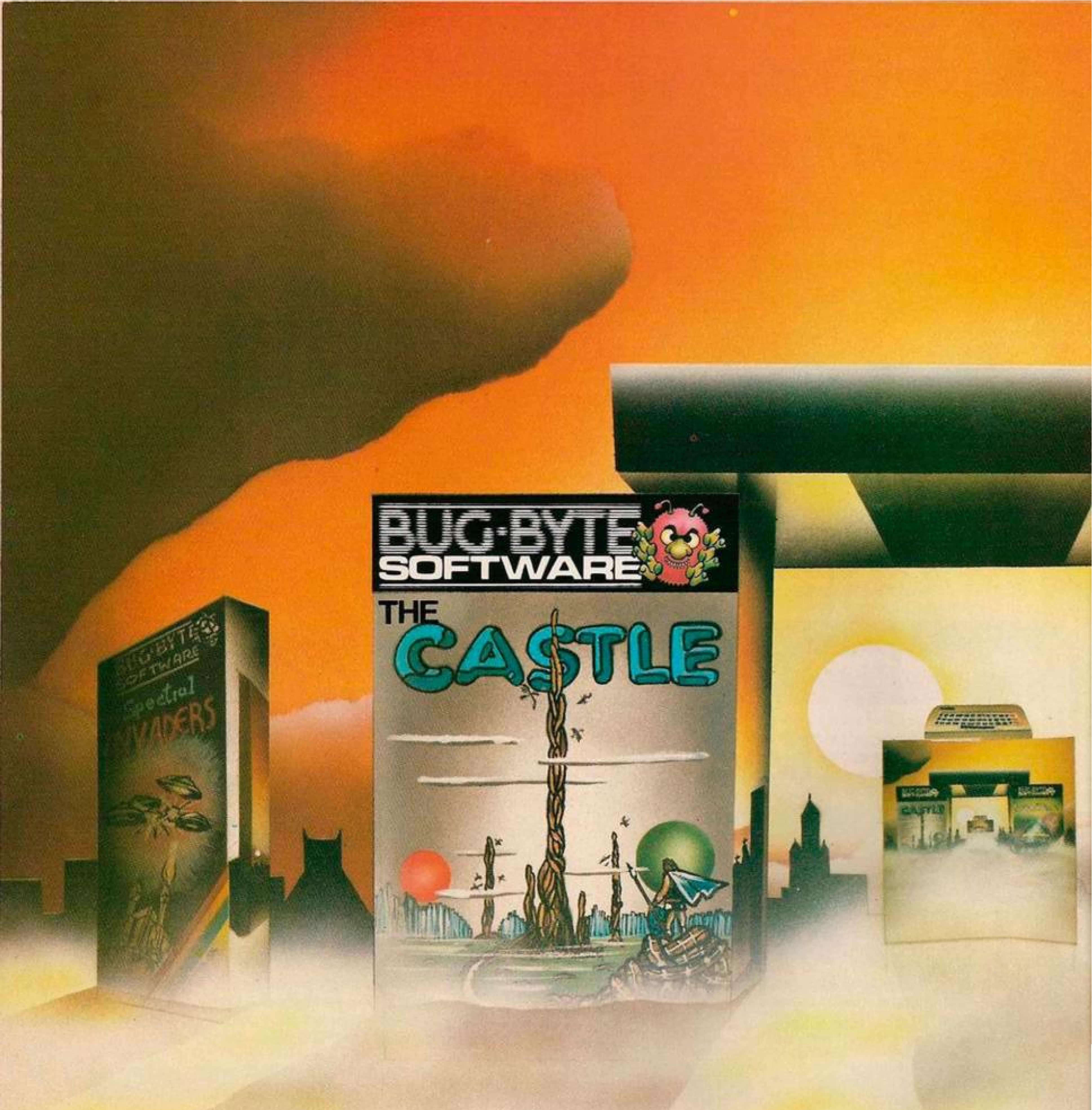
To make the game more exciting, better graphics and sounds can be developed. The graphics are fairly easy to achieve using the wide variety of commands such as Move, Draw and Plot available on the BBC. The sounds are not so easy to create because the Envelope command takes time to master. The sounds in this program were created using the Envelope-defining program published in the November 1982 issue of *Your Computer.*

The program is a space asteroids game with a difference. Where normal asteroids just amble across the screen these contain homing devices and high explosives. Just dodging them is not enough: you have to blow them out of the ether using quick reflexes and your laser cannon. Your craft can be moved through 360° and propelled using the thruster.

The control keys are: F0 left turn; F1 right turn; F2 a quick 180° turn; F3, F4, F5 hyperspace; F6 thrust; F7 fire.

```
>L.
    1 REM BY J.P.RIGGS 1983
    2 REM   GOSPORT,HANTS
   10 ONERROR RUN
   20 MODE7:PROCoff:*FX16,0
   30 DIMSI(90),CO(90):FORA%=0TO360STEP4:PRINTTAB(12,12):INT((360-A%)/36);" "::S
I(A%/4)=SINRAD(A%):CO(A%/4)=COSRAD(A%):NEXTA%
   40 *KEY10"OLD:MRUN:M"
   50 PROCoff:VDU23,224,24,24,60,60,126,126,231,231,23,225,60,69,153,165,165,153
,69,60:NU$=" "+CHR$224:*FX16,0
   60 PRINTCHR$12:TAB(0,0):STRING$(40,"*"):TAB(0,1)"* P S Y C H I C      A S T E
 R O I D S *";TAB(0,2):STRING$(40,"*"):*FX15,0
   70 PRINT'''"Do you want background noises (Y/N) ":ggg=GET:*FX9,5
   80 ONERROR GOTO160
   90 ENVELOPE1,1,-10,10,100,200,10,200,120,-100,-4,-1,120,127:*FX10,5
  100 FORX=100TO128:SOUND1,1,X,1:SOUND2,1,(255-X),1:NEXT:X=INKEY(20)
  110 HIGHSCORE=550:HIGHSCORER$="J.RIGGS":A$=" ":HS=550:MF=1.5
  120 ENVELOPE1,0,-8,-3,122,227,245,194,123,-76,-1,-6,126,126:ENVELOPE2,129,2,4,
6,28,14,7,0,0,0,-80,80,80
  130 ENVELOPE4,1,1,2,0,0,123,1,-110,0,-1,-20,125,70:ENVELOPE3,1,12,1,3,1,2,12,-
1,1,-1,-1,126,126
  140 XX%=RND(90)*4:ST%=640:RT%=512:A$="W":YO%=RT%:XI%=ST%
  150 SCORE=0:NOLEFT=3:JJ%=20:PROCastinit:*TV255,2
  160 MODE4:VDU19,0,1,0,0,0:PROCscore:PROCcalc:PROCstars(400):PROCdraw
  170 VDU24,&00,&00,&00,&00,&FF,&04,&BA,&03
  180 REPEAT PROCcontrol:PROCasteroid:UNTIL NOLEFT<=0:PROCend:GOTO140
  190 DEFPROCcontrol:REM Change ?236 TO ?215 AND DELETE B%=?237 and ORB%= for OS
 0.1
  200 A%=?236:B%=?237:IFA%=160 OR B%=160:XX%=XX%+8*RND(2):PROCdraw:PROCtest(a%,b
%,c):IF RND(3)=1 GOTO200
  210 A%=?236:IFA%=241 OR B%=241:XX%=XX%-8*RND(2):PROCdraw:PROCtest(a%,b%,c):IF
RND(3)=1 GOTO210
  220 IFA%=242 ORB%=242 XX%=XX%+180:PROCdraw:PROCtest(a%,b%,c):PROCasteroid
  230 IFA%=245 ORB%=245:PROCdistance:IF JJ%>(25*c) PROCthrust(70):PROCasteroid
  240 IFA%=148 OR A%=243 OR A%=244 A$="HYPERSPACE":PROCdraw:PROCtest(a%,b%,c)
  250 IFA%=148 OR A%=243 OR A%=244:IF RND(3)=1 NOLEFT=NOLEFT-1:VDU7:PROCscore
  260 IFA%=150 ORB%=150 AND RND(1)>0.35 PROCdistance:IF JJ%>40PROCfire:PROCaster
oid
  270 ENDPROC
  280 DEFPROCcalc:XX%=(360+(XX%<0)*ABS(XX%)-(XX%>0)*ABS(XX%)) MOD 360:X1=(XX%+18
0) MOD 360:X2=(XX%+215) MOD 360:X3=(XX%+145) MOD 360
  290 IF RT%>945 RT%=5:ST%=(1280-ST%) ELSE IF RT%<0 RT%=940:ST%=(1280-ST%):GOTO3
10
  300 IF ST%>1280 ST%=5:RT%=(1024-RT%) ELSE IF ST%<0 ST%=1275:RT%=(1024-RT%)
  310 Y%=SI(XX%/4)*38+RT%:YO%=SI((X3)/4)*42+RT%:YT%=SI((X2)/4)*42+RT%
  320 XO%=CO(XX%/4)*38+ST%:XI%=CO((X3)/4)*42+ST%:XT%=CO((X2)/4)*42+ST%
```

(continued on page 129)



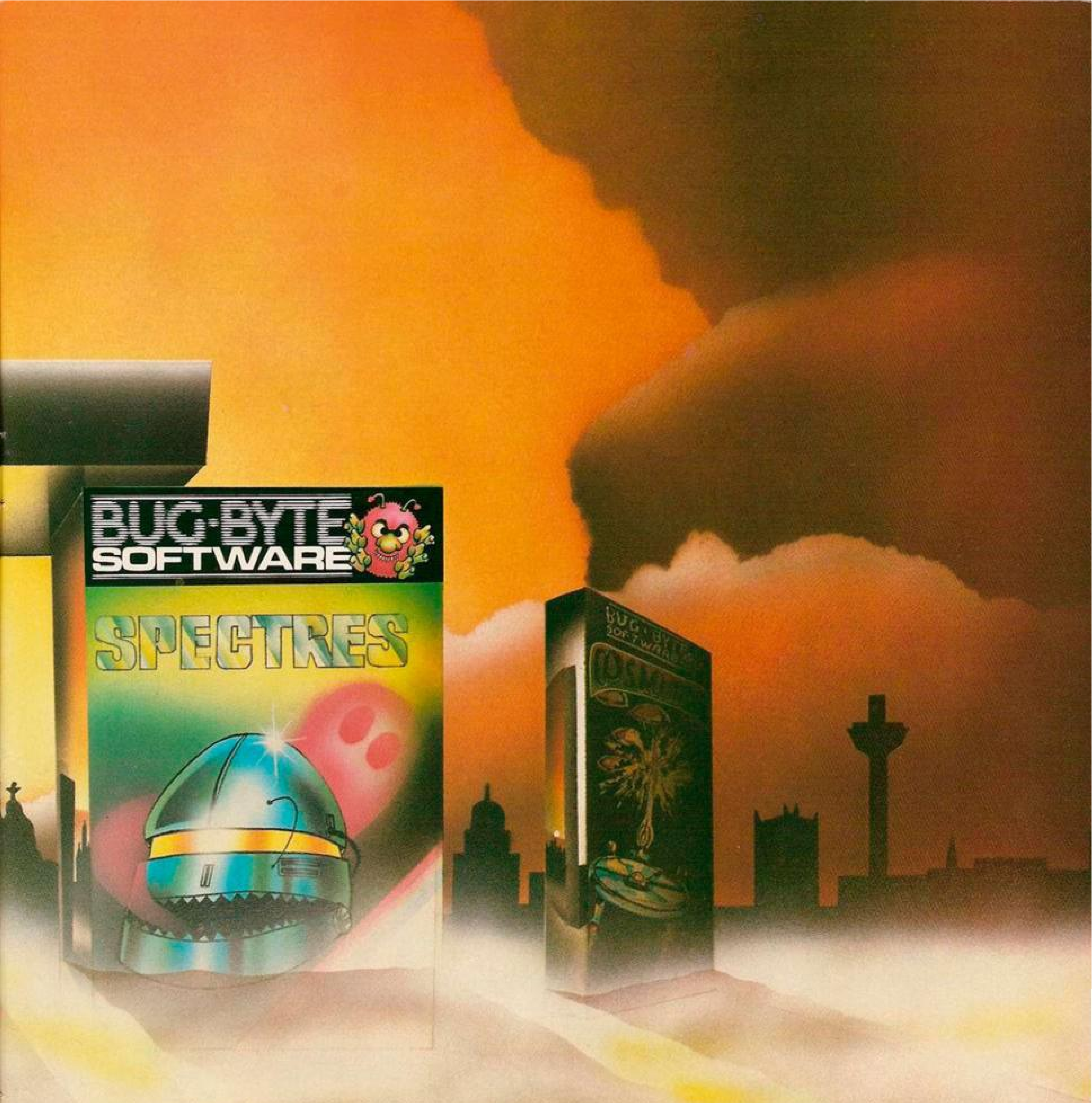
BUG-BYTE SOFTWARE, MORE THAN A GAM

All about me was darkness. Tens of thousands of screens stared blankly into space. Minds drifted aimlessly, dulled by lack of stimulation. The world was grey, drab, lacking . . .

Then suddenly it happened. First one, then another, then tens, hundreds, thousands of tired screens felt a surge of power and flickered back into life. They were much as I had seen on my own planet's microcomputers – the ZX 81, ZX Spectrum, Vic 20, BBC Micro and ORIC-1.

The minds paused to take stock. They clustered round the screens, their nimble fingers excitedly flicking the controls back and forth. At last they had found a challenge . . . action and adventure with cunning tests of dexterity and reaction. Everywhere, conversation was of Asteroids, Mazogs, Panic, Another Vic in the Wall.

Unable to resist, I too had a closer look. There before me was vivid colour, high resolution graphics. I could practically feel the spine-tingling



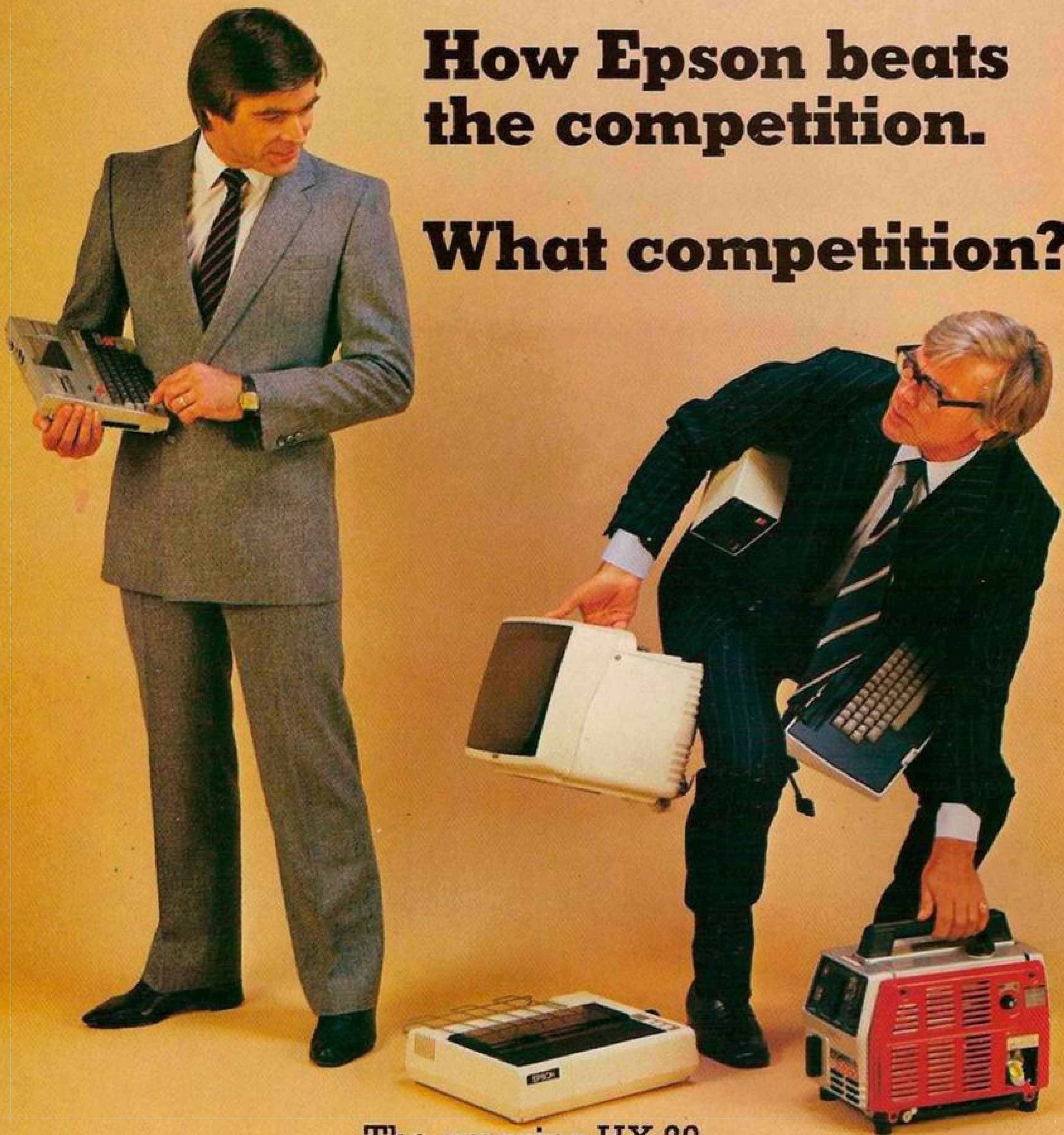
...IT'S A DOOR TO ANOTHER DIMENSION!

sound effects as whole battle fleets of Cosmiads swarmed out of nowhere and attacked. I should have known. As my fingers raced over the controls, and I prepared to stand and fight with only a single laser bolt for protection, I realised I was trapped!

Too late now, I remembered this was no ordinary software. I'd been warned, as I now warn anyone buying from Laskys, W.H. Smith, Currys Micro C, Spectrum and larger branches of Boots, and a nationwide network of dealers stocking Bug-Byte. Because Bug-Byte is more than a game, it's a door to another dimension. One that I had opened.

BUG-BYTE SOFTWARE

100 The Albany, Old Hall Street, Liverpool L3 3AB





(continued from page 124)

```
  330 CX%=CO((X1)/4)*11+ST%:CY%=SI((X1)/4)*11+RT%:ENDPROC
  340 DEFPROCdraw:IF RND(3)=1 AND A$<>"HYPERSPACE" PROCasteroid
  350 MOVEXO%,Y%:PLOT7,XI%,YO%:PLOT7,CX%,CY%:PLOT7,XT%,YT%:PLOT7,XO%,Y%
  360 IF A$="HYPERSPACE" RT%=RND(950):ST%=RND(1280):XX%=RND(360)
  370 A$="x":PROCcalc:MOVEXO%,Y%:DRAWXI%,YO%:DRAWCX%,CY%:DRAWXT%,YT%:DRAWXO%,Y%:
ENDPROC
  380 DEFPROCthrust(BO%):SOUND0,-15,100,8:RT%=RT%+SI(XX%/4)*BO%:ST%=ST%+CO(XX%/4
)*BO%:PROCdraw:ENDPROC
  390 DEFPROCfire:SOUND1,1,1,10:VDU5
  400 FY%=Y%+SI(XX%/4)*JJ%:FX%=CO(XX%/4)*JJ%+XO%
  410 FORMN=0TO1:GCOL0,1:MOVEXO%,Y%:DRAWFX%,FY%:PLOT0,0,16:PRINTCHR$225
  420   GCOL0,0:MOVEXO%,Y%:DRAWFX%,FY%:PLOT0,0,16:PRINTCHR$225
  430   NEXT:VDU4:PROCoff:GCOL0,1:IF SQR((FX%-a%)^2+(FY%-b%)^2)<25*c PROCastdest
  440 ENDPROC
  450 DEFPROCasteroid:IF RND(3)=1 PROCdiff
  460 IF ggg=89 AND RND(4)=1 SOUNDRND(3),3,RND(255),2
  470 PROCtest2:a%=a%+KT%:b%=b%+JT%:c=c*MF:MF=1/MF:MOVE(a%-10*c),(b%-10*c)
  480 DRAW(a%+20*c),(b%-5*c):DRAW(a%+25*c),(b%+25*c):DRAW(a%+5*c),(b%+30*c)
  490 DRAW(a%-10*c),(b%-10*c):PROCtest(a%,b%,c)
  500 IFa%>1280 OR b%>1024 OR a%<0 OR b%<0 PROCtest2:PROCastinit
  510 ENDPROC
  520 DEFPROCstars(NO)
  530 FORX=0TO NO:J%=RND(1280):K%=RND(1024):MOVEJ%,K%:PLOT69,J%,K%:NEXT:ENDPROC
  540 DEFPROCscore:PROCoff:IFSCORE>HS HS=SCORE
  550 IF NOLEFT<0 ENDPROC
  560 PRINTCHR$30;" SCORE=";SCORE;"    HIGH SCORE=";HS;TAB(25,1);STRING$(NOLEFT,
NU$);"  "
  570 ENDPROC
  580 DEFPROCdestroy:VDU19,0,0,0,0,0:NOLEFT=NOLEFT-1:PROCscore:*FX15,0
  590 SOUND0,-15,5,50:FORS%=1TO5:FORXPR%=1TO20 STEP2:D=INKEY(2):VDU23;13,XPR%,0;
0;0;:NEXT:FORXPR%=20 TO0STEP-2:D=INKEY(2):VDU23;13,XPR%,0;0;0;:NEXT,:A$="HYPERSP
ACE":PROCdraw:SOUND0,-15,6,12:A$="":VDU19,0,1,0,0,0:ENDPROC
  600   DEFPROCend:SOUND2,0,0,0
  610   VDU5:MOVE352,525:PRINT"G A M E    O V E R":VDU4:*FX15,0
  620   QQ=INKEY(1000):*FX15,0
  630   VDU22,7:PRINT''''"Your score is ";SCORE;" points"''
  640   PRINT"High score is ";HIGHSCORE;" points by";CHR$129;HIGHSCORER$''
  650   IF SCORE>HIGHSCORE HIGHSCORE=SCORE:PRINT"Yours is the highest score"':IN
PUT"Please enter initials ",HIGHSCORER$''
  660   HIGHSCORER$=LEFT$(HIGHSCORER$,4):INPUT"PRESS RETURN"A:HS=HIGHSCORE:ENDPR
OC
  670   DEFPROCastinit:RANDOM=RND(-TIME)
  680   c=(RND(30)+10)*(3E-2)
  690   REPEAT:Pos%=RND(4):a%=RND(1280)*(-1)*(Pos%=2 OR Pos%=4)-1280*(Pos%=3)
  700     b%=RND(960)*(-1)*(Pos%=1 OR Pos%=3)-950*(Pos%=2):UNTILABS(ST%-a%)>40
  710   PROCdiff:ENDPROC
  720   DEFPROCdiff:DIFFx%=(ST%-a%):DIFFy%=(RT%-b%):IFDIFFy%=0 OR DIFFx%=0 ENDPR
OC
  730   DX=DIFFx%/ABS(DIFFx%):DY=DIFFy%/ABS(DIFFy%)
  740   IF ABS(DIFFx%)>20 KT%=(RND(5)+8)*DX:JT%=DIFFy%/DIFFx%*KT%:ENDPROC
  750   IF ABS(DIFFy%)>20 JT%=(RND(5)+8)*DY:KT%=DIFFx%/DIFFy%*JT%:ENDPROC
  760   KT%=10*DX:JT%=10*DY:ENDPROC
  770   DEFPROCastdest:PROCtest2:SC=INT((SCORE+150-INT(50*c))/10)*10
  780   PROCextra:SCORE=SC:PROCscore:PROCexplosion(a%,b%,65,2.2):PROCastinit:PRO
Casteroid:ENDPROC
  790   DEFPROCtest2:MOVE(a%-10*c),(b%-10*c):PLOT7,(a%+20*c),(b%-5*c):PLOT7,(a%+
25*c),(b%+25*c)
  800   PLOT7,(a%+5*c),(b%+30*c):PLOT7,(a%-10*c),(b%-10*c):ENDPROC
  810   DEFPROCdistance:IF RND(3)=1 FF=2 ELSE FF=1
  820   JP%=SQR((a%-XO%)^2+(b%-Y%)^2):IF JP%<500 THEN JJ%=JP%/FF ELSE JJ%=JP%/2
  830   ENDPROC
  840   DEFPROCexplosion(XXX,YYY,ZZZ,WWW):IF c<0.7 VDU19,1,15,0,0,0,19,0,11,0,0,
0:JKK=67 ELSE JKK=69
  850   FORD=-ZZZ TO 0:IF D>-46 PP%=D/3 ELSE PP%=-15
  860     SOUND0,PP%,6,1:T=(150+D)*WWW:PLOTJKK,RND(T)-T/2+XXX,RND(T)-T/2+YYY:NEX
T:VDU19,0,1,0,0,0,19,1,7,0,0,0:ENDPROC
  870   DEFPROCextra:QP=(SC DIV 5000)*5000:IF SCORE>=QP ENDPROC ELSE NOLEFT=NOLE
FT+1:VDU7:ENDPROC
  880   DEFPROCtest(Q,W,E)
  890   PROCdistance:IF JP%<48 PROCdestroy:PROCtest2:PROCastinit:PROCasteroid
  900   ENDPROC
  910   DEFPROCoff:VDU23,1;0;0;0;0;:ENDPROC:REM  Change to VDU23,8202;0;0;0; for
OS 0.1
```

This program is specifically for the BBC model B but could be squeezed into a model A with a few changes: in line 160 change Mode4 to Mode5; in line 170 change the VDU24 to accommodate the new Mode; in line 560 the printing will have to be changed to make it neat; as there are four colours in Mode5 rather than two in Mode4 you can be more adventurous with the colours.

Interrupt-intercept

Simon Liston,
Walthamstow,
London.

SPECTRUM

THE ZX SPECTRUM produces an interrupt every 0.02 seconds. The Spectrum ROM uses this interrupt to increment the Frames system variable and also to see if any keys are being pressed. This short machine-code program causes the micro to Call address 63479 on each of these interrupts. I have written a real-time clock to illustrate one possible use of this facility.

First, reserve some memory; type Clear 63400. Next, Poke the 23 bytes of the interrupt-intercept into locations 65040-65062. Now, Poke the machine code for the real-time clock into locations 63479-63665. Check what you have Poked with the listing, then Save the code you have entered. Next, Enter Rand USR 65040.

You should now have a random time displayed in the top right-hand corner of the screen. Hours, minutes and seconds are stored in packed-bed format. Their respective addresses are: 63667, 63668 and 63669.

Setting the time, for example, 11:44:13 is done as follows:

POKE 63667, 1*16+1
POKE 63668, 4*16+4
POKE 63669, 1*16+3

Note that you must have a self-contained machine-code program at locations 63479-64760, that is, unless you know exactly what you are doing, you should Save all the registers and do not alter any system variables.

It is a good idea to end your routine not with ei; ret but with JP 56_{10}, this causes control to be passed to the usual interrupt routine.

The clock program given will keep good time so long as Load, Save, Beep, Copy or the printer are not used. Some other ideas: on every interrupt, Print the value of the system variable PPC to show you the line number being interpreted. This provides a simple trace mechanism. Or set SCR CT to 255 on every interrrupt, this will stop the Scroll? function being erased. Why not have a delay loop on every interrupt? This will slow down program execution — if it is not slow enough already.

```
65040   F3 21 F8 FC 01 10 01 36
65048   F7 23 0B 78 B1 20 F8 3E
65056   FD ED 47 ED 5E FB C9 00
65064   00 00 00 00 00 00 00 00

63479   DD E5 F5 C5 D5 E5 3A B2
63487   F8 3D 32 B2 F8 C2 46 F8
63495   3E 32 32 B2 F8 3A B5 F8
63503   A7 CE 01 27 32 B5 F8 FE
63511   60 C2 46 F8 AF 32 B5 F8
63519   3A B4 F8 A7 CE 01 27 32
63527   B4 F8 FE 60 C2 46 F8 AF
63535   32 B4 F8 3A B3 F8 A7 CE
63543   01 27 32 B3 F8 FE 13 C2
63551   46 F8 3E 01 32 B3 F8 DD
63559   21 18 40 3A B3 F8 CD 79
63567   F8 3E 0A CD 8C F8 3A B4
63575   F8 CD 79 F8 3E 0A CD 8C
63583   F8 3A B5 F8 CD 79 F8 21
63591   18 58 06 08 36 C7 23 10
63599   FB E1 D1 C1 F1 DD E1 C3
63607   38 00 F5 CB 3F CB 3F CB
63615   3F CB 3F CD 8C F8 F1 E6
63623   0F CD 8C F8 C9 DD E5 2A
63631   36 5C 11 80 01 19 EB 6F
63639   26 00 29 29 29 19 11 00
63647   01 06 08 7E EE FF DD 77
63655   00 23 DD 19 10 F5 DD E1
63663   DD 23 C9 1F 00 18 30 00
63671   00 00 00 00 00 00 00 00
org 50000 (65040)
```

```
* INTERRUPT INTERCEPT *
© Simon Liston 3/1/83
---------------------
Set Interrupt Mode 2 and
Initialize Interrupt Vector
Table

65040 F3          di
65041 21 F8 FC    ld hl,64760
65044 01 10 01    ld bc,272
Ilab
65047 36 F7       ld (hl),247
65049 23          inc hl
65050 0B          dec bc
65051 78          ld a,b
65052 B1          or c

65053 20 F8       jr nz,Ilab
65055 3E FD       ld a,253
65057 ED 47       ld i,a
65059 ED 5E       im 2
65061 FB          ei
65062 C9          ret

** Real Time Clock **

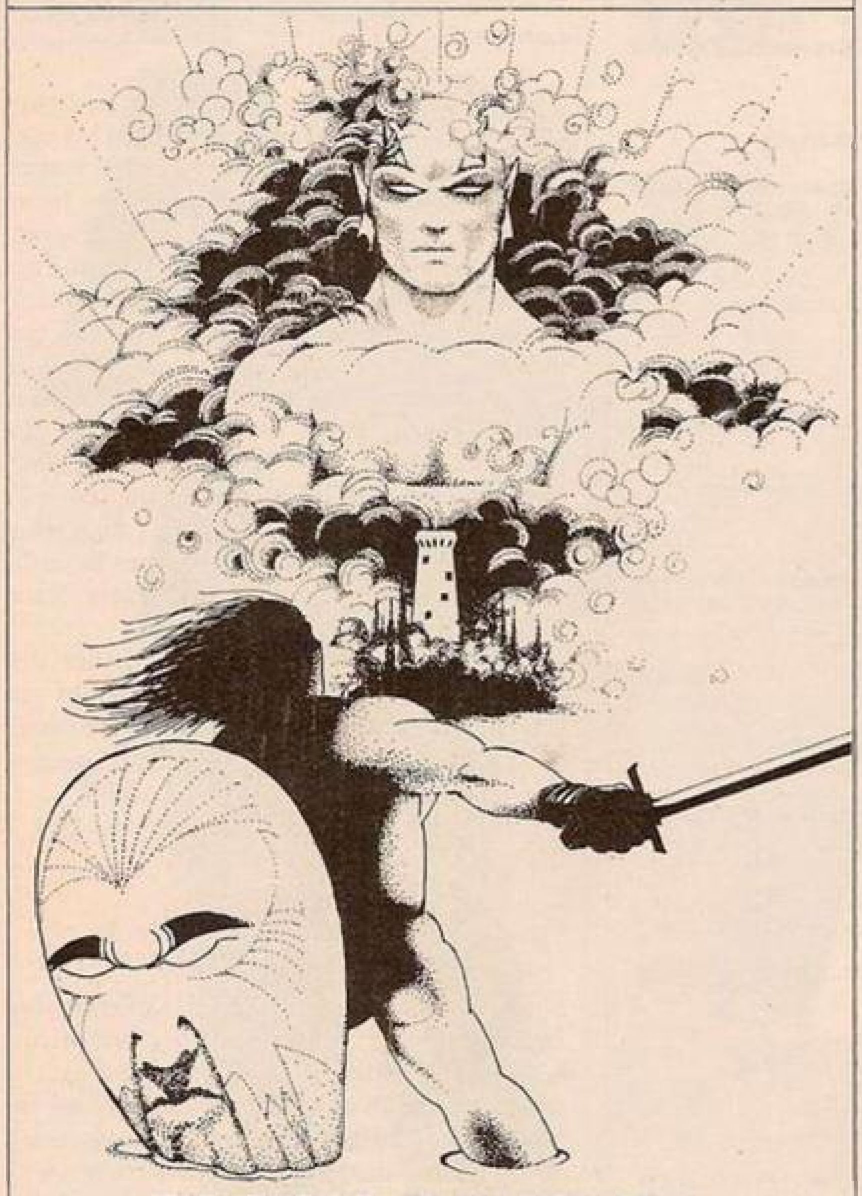
org 54998 (63479)
63479 DD E5       push ix
63481 F5          push af
63482 C5          push bc
63483 D5          push de
```

```
63484 E5          push hl
63485 3A B2 F8    ld a,(Real)
63488 3D          dec a
63489 32 B2 F8    ld (Real),a
63492 C2 46 F8    jp nz,Ptime
63495 3E 32       ld a,50

63497 32 B2 F8    ld (Real),a
63500 3A B5 F8    ld a,(Secs)
63503 A7          and a
63504 CE 01       adc a,1
63506 27          daa
63507 32 B5 F8    ld (Secs),a
63510 FE 60       cp 96
63512 C2 46 F8    jp nz,Ptime
63515 AF          xor a
63516 32 B5 F8    ld (Secs),a
63519 3A B4 F8    ld a,(Mins)
63522 A7          and a
63523 CE 01       adc a,1
63525 27          daa
63526 32 B4 F8    ld (Mins),a
63529 FE 60       cp 96
63531 C2 46 F8    jp nz,Ptime
63534 AF          xor a
63535 32 B4 F8    ld (Mins),a
63538 3A B3 F8    ld a,(Hours)
63541 A7          and a
63542 CE 01       adc a,1
63544 27          daa
63545 32 B3 F8    ld (Hours),a
63548 FE 13       cp 19
63550 C2 46 F8    jp nz,Ptime
63553 3E 01       ld a,1
63555 32 B3 F8    ld (Hours),a
Ptime
```

(continued on page 131)

SPECTRUM 48K : ZX81 16K
SIX PART ADVENTURE



BLACK CRYSTAL
THE QUEST IS ABOUT TO BEGIN

The ultimate role-playing adventure for the SPECTRUM/ZX81. You can become a warrior, elf or wizard on a quest to find and use the rings of creation: to destroy the Black Crystal and defeat the Lords of Chaos. Held within six programs lies a land of fabulous treasures and mythical monsters. Journey through the land of Beroth, explore the castle of shadows, descend into the Shaggoths lair, search for diamonds in the sea of sand but beware of sand sharks! Confront the fire demon in his temple, battle against the Lords of Chaos and win your way to the Black Crystal.

By splitting Black Crystal into six programs we can provide more variety and detail than any other adventure for the Sinclair computers.

Real time monster battles. Superb graphics. Save game feature. All six parts are supplied together on cassette, boxed with instruction booklet.

SPECTRUM 48K: 180K OF PROGRAM IN SIX PARTS — ONLY £7.50
ZX81 16K: OVER 100K OF PROGRAM IN SEVEN PARTS — ONLY £7.50
WHY PAY MORE FOR LESS OF AN ADVENTURE

CARNELL SOFTWARE

To: **CARNELL SOFTWARE, DEPT 2, 4 STAUNTON RD, SLOUGH, SL2 1NT.**
Please send me: Black Crystal for my,

☐ Spectrum 48K................ £7.50
☐ ZX8 16K.................... £7.50

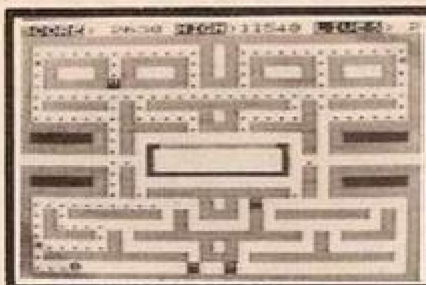
I enclose a cheque/postal order (payable to Carnell Software) for £ ______

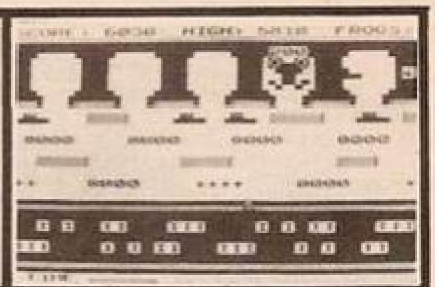
NAME..

ADDRESS...

....

TRADE ENQUIRIES WELCOME





ZUCKMAN
ZX81 (16K)

*ALL MACHINE CODE (10K)
*FOUR INDEPENDENT GHOSTS
*HIGH-SCORE 'HALL OF FAME'
*AUTHENTIC ARCADE ACTION
*TITLE/DISPLAY MODE

ONLY £5.95 INC. P&P

FROGGER
ZX81 (16K)

*MOVING CARS, LOGS, TURTLES
*ALLIGATORS, DIVING TURTLES
*FOUR 'SCREENS' OF ACTION
*ALL ARCADE FEATURES
*ENTIRELY MACHINE CODE

ONLY £5.95 INC. P&P

NEW ☆ **DRAGON 32 SOFTWARE** ☆ NEW

MISSILE COMMAND.......................ONLY £5.95
FULL HIGH-RESOLUTION COLOUR GRAPHICS + SOUND

GRAPHICS DEMONSTRATOR...........ONLY £5.95
LEARN THE SECRETS OF HI-RES GRAPHICS PROGRAMMING

DJL SOFTWARE
DEPT YC, 9 TWEED CLOSE, SWINDON, WILTS SN2 3PU

TRADE ENQUIRIES WELCOME

SOUND with SINCLAIR

MAKE AMAZING SOUND EFFECTS WITH YOUR ZX 81, TIMEX Sinclair 1000 or SPECTRUM



THE ZON X
£25.95
incl p&p & VAT



★ The ZON X SOUND UNIT is completely self-contained and especially designed for use with the ZX 81, TIMEX Sinclair 1000 and Spectrum Computers. It just plugs in — no dismatling or soldering.

★ No power packs, batteries, leads or other extras.*

★ Manual Volume Control on panel — ample volume from built-in loud-speaker.

★ Standard Sinclair — 16K Rampack or printer can be plugged into ZON X Sound Unit without affecting normal computer operation.

★ Huge range of possible sounds for Games, Music, Helicopters, Sci-Fi, Space Invaders, Explosions, Gun-shots, Drums, Planes, Lasers, Organs, Bells, Tunes, Chords, etc., or whatever you devise!

★ 8 full octaves. Uses 3-Channel sound chip giving programme control of pitch, volume of tones and noises, all with envelope control.

★ Easily added to existing games or programmes using a few simple "BASIC" lines or machine code.

★ No memory addresses used — I.O. mapped.

FULL instructions with many examples of how to obtain effects and the programmes, supplied, fully guaranteed. British Made.

**Except with Spectrum, you need the Spectrum Extension Board Order No. SE1 — Price £6.80 incl. V.A.T.*

Payment may be made by Cheque. P.O. Giro No. 388 7006. Postal Order or Credit Card.

Export orders :— Bank Cheque. International Money Order. U.S. $ or £ Sterling.

BI-PAK Dept YC2, P.O. Box 6, 63A, High Street, Ware, Herts.

Access & VISA accepted
Ring 0920 3182 for immediate despatch

(continued from page 129)

```
63556 DD 21 18 40  ld ix,16408
63562 3A B3 F8     ld a,(Hours)
63565 CD 79 F8     call Pdec
63568 3E 0A        ld a,10
63570 CD 8C F8     call Pch
63573 3A B4 F8     ld a,(Mins)
63576 CD 79 F8     call Pdec
63579 3E 0A        ld a,10
63581 CD 8C F8     call Pch
63584 3A B5 F8     ld a,(Secs)
63587 CD 79 F8     call Pdec

63590 21 18 58     ld hl,22552
63593 06 08        ld b,8
At
63595 36 C7        ld (hl),199
63597 23           inc hl
63598 10 FB        djnz At
63600 E1           pop hl
63601 D1           pop de
63602 C1           pop bc
63603 F1           pop af
63604 DD E1        pop ix
63606 C3 38 00     jp 56

Pdec
63609 F5           push af
63610 CB 3F        srl a
63612 CB 3F        srl a
63614 CB 3F        srl a
63616 CB 3F        srl a
63618 CD 8C F8     call Pch

63621 F1           pop af
63622 E6 0F        and 15
63624 CD 8C F8     call Pch
63627 C9           ret

Pch
63628 DD E5        push ix
63630 2A 36 5C     ld hl,(23606)
63633 11 80 01     ld de,384
63636 19           add hl,de
63637 EB           ex de,hl
63638 6F           ld l,a
63639 26 00        ld h,0
63641 29           add hl,hl
63642 29           add hl,hl
63643 29           add hl,hl
63644 19           add hl,de
63645 11 00 01     ld de,256
63648 06 08        ld b,8
Ur

63650 7E           ld a,(hl)
63651 EE FF        xor 255
63653 DD 77 00     ld (ix+0),a
63656 23           inc hl
63657 DD 19        add ix,de
63659 10 F5        djnz Ur
63661 DD E1        pop ix
63663 DD 23        inc ix
63665 C9           ret

Real
defb 50
Hours
63667 00           nop
Mins
63668 00           nop
Secs
63669 00           nop
```

Chords

Bernard Dembowski,
Feltham,
Middlesex.

ACE

THREE TYPES of chord are described by this program: major, minor and seventh. Each chord consists of eight notes played in rapid succession, similar to the banjo cross-picking style. A bar — four beats — requires 16 notes. Within the confines of this Forth program, if one chord lasts the length of the bar, you enter it twice. In other words, one chord entry equals two beats.

Now for the program. First enter a variable, T; this is the length of each note in milliseconds. This governs the tempo of your tune. Next, define the word Chord, then define the chords you need for your tune. The Jupiter Ace's memory is not sufficient to store all the chords shown, so just define the chords you need. Unfortunately, this method is not suitable for waltzes, that is, anything in three-four time. In the example the chords are written out exactly as you would enter them into the Ace.

Michael, row the boat ashore
150 T !
D D D D G G D D F# m F# m Em Em D A7 D D

House of the Rising Sun
200 T !
Dm F G Bb Dm F A7 A7 Dm F
G Bb Dm A7 Dm F Dm F G
Bb Dm F A7 A7 Dm F G Bb
Dm A7 Dm Dm

```
100 VARIABLE T
: CHORD 8 0 DO T @ BEEP LOOP ;

( MAJOR )
: C 319 379 239 319 379 239 319 379 CHORD ;
: F 179 358 284 179 358 284 179 358 CHORD ;
: G 319 426 253 319 426 253 319 426 CHORD ;
: D 338 426 284 338 426 284 338 426 CHORD ;
: A 284 379 451 284 379 451 284 379 CHORD ;
: E 301 379 253 301 379 253 301 379 CHORD ;
: Bb 358 426 268 358 426 268 358 426 CHORD ;
: Eb 319 402 268 319 402 268 319 402 CHORD ;
: Ab 301 402 478 301 402 478 301 402 CHORD ;
: Db 301 358 451 301 358 451 301 358 CHORD ;
: Gb(F#) 268 338 451 268 338 451 268 338 CHORD ;
: B 253 338 402 253 338 402 253 338 CHORD ;
( MINOR )
: CM 402 319 239 402 319 239 402 319 CHORD ;
: FM 358 301 239 358 301 239 358 301 CHORD ;
: GM 426 319 268 426 319 268 426 319 CHORD ;
: DM 426 358 284 426 358 284 426 358 CHORD ;
: AM 379 284 239 379 284 239 379 284 CHORD ;
: EM 379 319 253 379 319 253 379 319 CHORD ;
: BbM 358 451 268 358 451 268 358 451 CHORD ;
: EbM 338 268 402 338 268 402 338 268 CHORD ;
: AbM 402 301 253 402 301 253 402 301 CHORD ;
: DbM 379 301 451 379 301 451 379 301 CHORD ;
: GbM(F#M) 338 284 451 338 284 451 338 284 CHORD ;
: BM 426 338 253 426 338 253 426 338 CHORD ;

( SEVENTH )
: C7 379 319 268 379 319 268 379 319 CHORD ;
: F7 402 358 239 402 358 239 402 358 CHORD ;
: G7 426 358 253 426 358 253 426 358 CHORD ;
: D7 426 338 239 426 338 239 426 338 CHORD ;
: A7 379 319 451 379 319 451 379 319 CHORD ;
: E7 426 379 253 426 379 253 426 379 CHORD ;
: Bb7 358 301 426 358 301 426 358 301 CHORD ;
: Eb7 402 319 451 402 319 451 402 319 CHORD ;
: Ab7 402 338 239 402 338 239 402 338 CHORD ;
: Db7 358 301 253 358 301 253 358 301 CHORD ;
: Gb7(F#7) 338 379 451 338 379 451 338 379 CHORD ;
: B7 338 284 402 338 284 402 338 284 CHORD ;
```

Stuntman

C Szponjnarowicz,
Hounslow,
Middlesex.

ATOM

STUNTMAN uses high-resolution graphics, and creates realistic motor bike sound effects. The program fits into 2.5K but high-resolution is also needed.

The basic idea is that the motorcyclist has to jump as many buses possible. To acquire the correct speed, press Control to accelerate, Shift to decelerate, and Repeat to jump. The correct speed is equal to the number of buses multiplied by 10.

The exact speed would be too difficult to get, so at the start of the progam the skill level is asked for. Now the speed to successfully jump all the buses is greater than the number of buses, but less than the number of buses combined with the current skill level.

There are two starting roads before the final road, where the correct speed has to be attained. If you travel too fast, the bike crashes into the ramps. If you travel too slowly, the bike will not generate enough speed and will fall killing your man. If you attempt to jump before the third road, the bike crashes, losing one of your three lives.

When the roads have been drawn, and the

(continued on page 133)



IMPACT SOFTWEAR

From Scotland's Capital comes quality software for the

ZX Spectrum, VIC 20 & now also Dragon 32

The Quest

(48K – Spectrum; Dragon 32)

(One of the most exciting adventure games currently available). Fight your way into the depths of the complex in your Quest for the Holy Grail. Discover Gold and Precious stones, buy weapons and Magic wares from a trader. Battle with one of the many Monsters. Up to 1500 locations may be searched in the course of a game. Full sound effects and save game facility. Only £5.00

Star Trek

(16K Spectrum; 8K – VIC 20; Dragon 32)

Save the Galaxy from the Klingons using your rapid fire phasers and photon torpedos. Automatic short range scan, Galaxy map and Star-bases.

Full sound effects and 10 levels of difficulty! Only £5.00

Orb

(48K – Spectrum; 16K – VIC 20; Dragon 32)

Make your way through the underground labarynth in your search for the dreaded Orb, which you must destroy. Encounter many Monsters, discover Treasure and try to remember your route so that you can get out again. Full sound effects and save game facility.

Only £5.00

NEW! 3-D Maze

(48K – Spectrum; Dragon 32)

Exciting 3-Dimensional Maze Game! Search for the 3 fabulous treasures, then make your way back to the exit. Time yourself with the On Screen Clock. But Beware the treasures are not always in the same locations.

Only £5.00

Star fighter

(16K – Spectrum)

All action, full-colour, graphic machine-code, Space-battle with devastating explosions. On screen scoring and high score kept. The longer you survive the more difficult it becomes. – Only £5.00

Games Pack (Unexpanded VIC 20)

Alien * Road Race *
The Island * Pontoon *
Only £5.00



ALL ORDERS DESPATCHED BY RETURN

Dealers Attractive Discounts
Spectrum & VIC 20 programmes wanted 25% Royalties Paid

I enclose a Cheque/PO. for £ ....
Name ________
Address ________
________ Post Code ________
All prices **include** P&P and VAT

IMPACT SOFTWARE
70, Redford Avenue,
EDINBURGH EH13 0BW
TEL. 031-441-4257

Please Supply:

The Quest (£5·00)	☐	3-D Maze (£5·00)	☐
Orb (£5·00)	☐	Starfighter (£5·00)	☐
Star Trek (£5·00)	☐	Games Pack (£5·00)	☐

Please state machine type: ________

NOW FOR ZX SPECTRUM

Victagraph plot window.

PLOT, DRAW PACKAGE

An essential aid to all computer owners *with Plot, Draw or similar,* to an absolute and/or offset co-ordinate.

Now Compatable with ZX Spectrum

Are you finding ZX Spectrums Plot, Draw difficult and slow to work out? . . . Yes . . .

Then you need Victagraph Plot Window.

Place your drawing etc. in the Victagraph and you are ready to plot all the points, using the movable window mask, offset screen and easy to read scale. Victagraph will also help with circle, and parts of circle with the ZX Spectrum. All this without graphpaper.

Total price £7.50 — Cheques/P.O. — payable to Victa Ceramics. UK only.

VICTA CERAMICS
6A BOW STREET, RUGELEY
STAFFS. WS15 2BT.

STAR SOCCER



AN EXCITING NEW GAME FOR THE ZX81 (16K)

- ALL THE ACTION OF REAL FOOTBALL PASS – SHOOT – DRIBBLE – TACKLE CORNERS – FREE KICKS – THROW-INS
- YOU PLAN THE MOVES – SEE THE PLAY IN HIGH SPEED GRAPHICS
- MATCHES BETWEEN 12 TOP CLUB SIDES AND 12 *STAR* WORLD CUP SQUADS
- MORE THAN AN ARCADE GAME MORE THAN A SIMULATION

'A truly original and absorbing game'

ONLY £5.95

Please make cheques and postal orders payable to:

Watson Software Services Ltd.

1, Ivy Cottages, Long Road West, Dedham, Essex CO7 6EL

Allow 14 days for delivery

(continued from page 131)

bike appears at the top of the screen, press any key to start. This happens each time the bike is positioned at the top left-hand corner of the screen.

The first line, retains the high score — value of H — even if Break has been hit, but set the value to 0 when the program is first loaded.

In some places — for example, 8000-8300 and 9000-9300 the Plot statement has been used instead of Move and Draw. This is for ease in typing. For example once lines 8000-8300 have been typed, it is a simple matter of editing these lines, changing the line number to 9000, 9200 and 9300 and changing the Plot 13 to Plot 15.

Line 8100 does not have to be edited because it is used to delete remnants of the bike before the ramp. This editing can also be used for lines 270 converted to 307 — remembering to delete the Goto variable i.

```
>L.
    1IFH<0 H=0;REM STUNT MAN
    5P.$12"            STUNT MAN"'"   BY C.SZPOJNAROWICZ 1/1/83"''
    6P."THE OBJECT OF THE GAME IS TO "'"JUMP AS MANY BUSES AS"
    7P." POSSIBLE."''"THE CONTROLS ARE"'"  CTRL-ACCELERATE"'
    8P."  SHIFT-DECELERATE"'"  REPT-JUMP"'
   10P.''"SKILL LEVEL"'
   11IN."1 IMPOSSIBLE TO 1000 EASY"'J
   13L=0;S=10;A=150;X=50;Y=30;U=2;I=151;Z=1;V=110;W=30
   14G=-1;K=V-X-40;T=50;N=50;M=30;F=J
  150CLEAR4
  200aF.Q=0TO256 S.2;PLOT13,Q,(A-1);N.Q
  210F.Q=1TO257 S.2;PLOT13,Q,(A-2);N.Q
  220F.Q=0TO256 S.2;PLOT13,Q,(A-3);N.Q
  230A=A-60;IF A>10 G.a;A=30
  250REM DRAW RAMP
  270iPLOT15,V,W;PLOT7,(V-19),(W+10);PLOT7,(V-19),W;PLOT7,V,W
  275V=V+10
  300REM BIKE
  301sPLOT13,X,Y;PLOT5,(X+19),(Y+10);PLOT5,(X+19),Y;PLOT5,X,Y
  302IF T<>100 G.z
  303pS=10*Z;U=2;I=151;Z=1;X=50;Y=30
  306PLOT13,X,Y;PLOT5,(X+19),(Y+10);PLOT5,(X+19),Y;PLOT5,X,Y
  307PLOT13,V,W;PLOT5,(V-19),(W+10);PLOT5,(V-19),W;PLOT 5,V,W
  308PLOT13,U,I
  309LI.£FFE3
  310bPLOT15,U,I;U=U+Z;PLOT13,U,I
  312IFI=31 AND U>(X+20) G.d
  313IFI=31 PLOT15,(X-3),(Y+1);PLOT7,(X-1),(Y+1)
  315?£B002=5;?£B003=4
  330IFU>=256 I=I-60
  335IFU>=256 U=0
  340IFZ<1 Z=1
  350IF?£B001&£40=0 Z=Z+1
  360IF?£B002<128 Z=Z-1
  370IF?£B002&£40=0 G.c
  400 G.b
 2000cIF I<>31 G.d
 2010S=10*Z;K=V-X-40
 2030IFU<(X-1) G.b
 2040IF?£B002&£40=0 AND U>(X-10) U=X
 2050IFU>(X+1) G.d
 3000REM JUMP
 3020IFS<K G.t
 3025IFS>(K+J) G.d
 3027G.e
 3030IFS<K G.t
 3031IFS>(K+J) G.d
 3032tPLOT15,U,I;U=U+2;I=I+1;PLOT13,U,I
 3033?£B002=5;?£B003=4
 3034WAIT;WAIT;WAIT;WAIT;IFU<64+(K/2) G.t
 3035rPLOT15,U,I;I=I-1;U=U+2;?£B002=5;?£B003=4;PLOT13,U,I
 3036WAIT;WAIT;WAIT;WAIT;IFI>41 G.r
 3037G.d
 3040IF S>(K+J) G.d
 3045G.e
 3090G.300
 5000ePLOT15,U,I;U=U+2;I=I+1
 5005PLOT13,U,I
 5006WAIT;WAIT
 5007?£B002=5;?£B003=4
 5008IFU>(X+19)+(K/2) G.f
 5010G.e
 6000fPLOT15,U,I;U=U+2;I=I-1;PLOT13,U,I
 6002?£B002=5;?£B003=4
 6003WAIT;WAIT;WAIT
 6004IFI>31 G.f
 6100I=31
 6105PLOT15,U,I;U=U+1;PLOT13,U,I
 6110?£B002=5;?£B003=4;WAIT;WAIT
 6120IFU<V+20G.6100
 6122F=F-(F/3)
 6123T=50;Z=1
 6127PLOT15,U,I;G.i
 6130iG.270
 7000uIFK=20 K=0
 7005D=(K/10)
 7010 P.$12"YOU HAVE KILLED 3 MEN "'"YOU JUMPED"
 7050P.D" BUSES"'
 7100P."YOUR SCORE WAS"K
 7130IFK>H H=K
 7140P. '"AT SKILL LEVEL"J
 7150P.'"THE HIGH SCORE IS"H
 7250IN.'"WOULD YOU LIKE ANOTHER GO "$T.
 7300 IF?T.=CH"N" E.
 7350IN."WOULD YOU LIKE INSTRUCTIONS "$T.
 7360IF?T.=CH"N"G.10
 7370G.5
 7400E.
 8000dPLOT13,(U+2),(I+2);PLOT5,(U-2),(I-2)
 8100PLOT15,(U-2),I;PLOT 7,(U+2),I
 8200PLOT13,(U-2),(I+2);PLOT5,(U+2) ,(I-2)
 8300PLOT13,U,(I+2);PLOT5,U,(I-2)
 8350F.Q=0TO400;?£B002=Q;N.Q;Z=1;PLOT15,U,I;L=L+1
 8560IF L=3 G.u
 9000yPLOT15,(U+2),(I+2);PLOT7,(U-2),(I-2)
 9200PLOT15,(U-2),(I+2);PLOT7,(U+2) ,(I-2)
 9300PLOT15,U,(I+2);PLOT7,U,(I-2)
 9350T=100
 9400G.S
 9500zPLOT13,(N+21),M;PLOT5,(N+22),M
 9510PLOT13,(N+27),M    ;PLOT5,(N+28),M;M=M+1;IF M<32 G.z
 9520wPLOT13,(N+21),M;PLOT5,(N+28),M;M=M+1;IF M<40 G.w
 9525M=30
 9527MOVE(N+22),(M+10);DRAW(N+27),(M+10)
 9530PLOT15,(N+23),(M+8);PLOT7,(N+26),(M+8)
 9532PLOT15,(N+23),(M+7);PLOT7,(N+26),(M+7)
 9533N=N+10
 9535G=G+1;IF G<(K/10) G.z
 9540G.p
```

Hi-res mover

Jan Erik Lundberg,
Solna,
Sweden.

SPECTRUM

IMPRESSED BY THE SMOOTH action of the hi-res graphics in Psion's Planetoids for the Spectrum I just had to have a go at writing a machine-code subroutine that could do a similar job. I hope that it will be useful for the readers who want to write their own programs using moving graphics.

Overcomplicated Basic programs would be too slow but perhaps a compiled version would be better.

The demonstration driver program is only intended to show how to use the routine and demonstrate its good and bad features.

See what happens when you change the mode — 0 to 3. The subroutine writes or erases the user-defined graphic in high-res — 172×256. You can expand them from 21 to 32. It is position-independent coded, PIC, and you should start to load it 600 bytes lower than the UDG pointer. Perhaps it is easier to load it directly from the memory dump.

```
   1 REM HiRes Mover &Jel
   2 CLEAR 31999
   3 POKE 23609,30
  10 RESTORE 3000
  15 FOR a=32000 TO 32335
  20 READ n: POKE a,n
  30 NEXT a
  40 RESTORE 55
  45 FOR a=32601 TO 32606
  50 READ n: POKE a,n
  55 DATA 60,126,126,126,126,60
  56 NEXT a
  60 LET xa=23728
  61 LET ya=xa+1
  62 LET cha=23677
  63 LET moa=cha+1
  70 REM 0<y<192   0<x<255
  71 REM ch=ink+8*(code-144)
   144<=code<=164 (could be
   expanded to max 31 by
   lowering (udg) 80 bytes)
  72 REM mo=1 colour change dis-
   sable. mo=2 no restoring
  80 LET x=100
  85 LET y=32
  86 BORDER 6: INK 1: PAPER 6
  89 LET xr=1: LET yr=1
  90 PRINT AT 0,0; INK 1;"
"
  91 PRINT AT 21,0; INK 5;"
"
  92 FOR i=1 TO 20: PRINT AT i,0
 INK 2;"
 ": NEXT i
  93 FOR i=1 TO 23: PRINT AT RND
*20+.5,RND*30+.5;"  ": NEXT i
  95 POKE moa,2: REM "eat" mode
  98 POKE cha,2: REM write red
 100 POKE ya,y
 101 POKE xa,x
 105 LET l=USR 32000: REM write
 108 IF l=1 THEN PRINT AT 2,20;"
HIT": BEEP .2,50
 109 IF l=0 THEN PRINT AT 2,20;"
   "
 111 IF INKEY$="5" THEN LET xr=-
1
 112 IF INKEY$="8" THEN LET xr=1
 113 IF INKEY$="7" THEN LET yr=1
 114 IF INKEY$="6" THEN LET yr=-
1
 115 LET x=x+xr
 117 LET y=y+yr
 119 LET l=USR 32004: REM erase
 120 GO TO 100
1999 STOP
3000 REM finds moverpointer IX
write erase flag (in af') clears
23678 for later use as hit and
colour change flags
3010 DATA 175,55,24,1,175,71,8,3
3,126,92,126,230,7,119,45,126,23
0,248,79,126,230,7,46,143,87,126
,230,248,178,119,221,42,123,92,2
21,9,17,139,255,221,25
3050 REM sets attrpointer accord
ing to Y, pushs it on stack AND
leaves with a=y mod 192
3060 DATA 33,224,90,14,32,58,177
,92,214,192,48,2,198,192,95,22,0
,167,237,66,146,48,251,130,9,229
,123
3100 REM sets picpointer HL acco
rding to y and leaves D with lin
es left in row, E with 1 if row=
0 (=warning for bankshift)
3110 DATA 33,224,87,88,14,64,237
,82,145,48,251,129,25,14,32,30,9
,29,237,66,146,48,250,130,9,184,
40,5,21,37,61,32,251
3150 REM adjust pointers for x
and push attrpointer on stack
c=rest in x, b=8 lines to scan
3160 DATA 58,176,92,184,40,12,19
3,35,3,214,8,48,250,198,8,43,11,
197,79,6,8
3300 REM main line scan loop
writes or erases the dots ,sets
up the flag register for later
use in colour part
3305 REM adjusts all data for re
st in x
3310 DATA 197,213,229,121,221,70
,124,14,0,86,35,94,221,102,132,1
```

(continued on page 135)

Introducing -

Ⓒ SOFTWARE

SUPER CHESS II

For Sinclair 48K SPECTRUM

THE BEST at £7·95

Ⓒ SOFTWARE

Spectrum software

Specialists in high quality, intelligent games

Guaranteed able to beat Sargon II and all other Spectrum chess programs !!!

- Six levels of play
- Plays a variety of openings e.g. French Defense, Sicilian Defense, Ruy Lopez, Queen's Gambit etc. ✸ Self play mode ✸ Analyse mode
- Enhanced end-game play ✸ Recommended move option

Available only from the address below – dealer enquiries welcome

●● ORIGINAL SUPERCHESS ●● The Cheapest

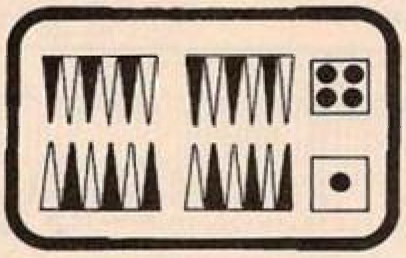
10 levels of play : recommended move option : substantial 'opening book' e.g. French Defense, Queen's Gambit, Ruy Lopez etc : self play feature : analyse mode.

48k Spectrum – £4.95
16k ZX81 – £4.95

●● ZX DRAUGHTS ●●

Did you know that a computer draughts program has beaten the world draughts champion?
Draughts is an ideal game to apply tree searching techniques to. Our program analyses each position in depth making it a formidable opponent. Choice of colour. 10 levels of play, at level 5 (response time – 20 seconds) it beats its own programmer!

48k Spectrum – £6.95



●● BACKGAMMON ●●

Play this fascinating game of skill and chance.
High resolution colour display with dice roll. Can be used by expert players and also has documentation to enable beginners to learn the game.

48k Spectrum – £5.95

●● SPECTRUM SPEECH ●●

Yes it's possible! Software driven speech from the Spectrum. Simple to use in your own programs. Each cassette comes with user documentation and demonstration program. No extra hardware is required. Uses Spectrum speaker and top 32k Ram.

SOFTALK I: 'Multiwords' 70+ words, numbers zero to million, plus, go, limit, right, great etc . . . **48k Spectrum – £6.95**

SOFTALK II: 'Spacegames' 80+ words, numbers, red alert, torpedoes, phasors, bearing south etc. . . **48k Spectrum – £6.95**

●● SPECTRUM ASSEMBLER ●●

An essential aid for m/c programmers. User documentation supplied with each cassette.

16k and 48k Spectrum – £4.95

UK Prices include post & packing. Despatch within 48 hours of receipt of order.
(For orders outside UK add 80p for postage)
Send cheque or postal order to:
CP SOFTWARE, Dept.YC, 17 Orchard Lane, Prestwood, Bucks. HP16 0NN

PROGRAMMERS – TOP RATES PAID FOR HIGH QUALITY SPECTRUM STRATEGY GAMES AND SPECTRUM FORTH.
SEND YOUR MATERIAL FOR EVALUATION AND PROMPT REPLY.

(continued from page 133)

```
05,185,40,15,203,56,203,25,203,6
0,203,29,203,35,203,18,61,32,241
3320 REM  write or erase and set
 up flags
3330 DATA 229,33,126,92,203,94,3
2,12,184,40,2,203,230,165,40,14,
203,238,24,10,184,40,2,203,246,1
85,40,2,203,254,8,48,28,8,221,12
8,124,162,40,8,203,214,203,70,40
,2,22,0,221,114,132,225,226,126,
176,119,35,126,177,24,15,8,209,2
25,120,47,70,160,178,119,35,121,
47,78,161,178,119,43,209,193
3400 REM end of main scanning lo
op. Adjusts pointers for   next
byte to be written
3410 DATA 221,43,21,40,5,37,16,1
34,24,28,5,40,25,4,229,33,126,92
,203,222,225,197,1,224,6,29,40,4
,9,193,24,230,8,255,9,193,24,224
3500 REM writes the appropriate
attributes and returns with bc=1
if any hit
3510 DATA 33,141,92,8,48,2,46,14
3,8,126,46,126,209,203,86,40,4,2
03,70,32,28,1,223,255,203,102,40
,1,18,19,203,110,40,1,18,235,9,2
35,203,118,40,1,18,19,203,126,40
,1,18,1,0,6,8,86,2,203,150,203,8
6,200,12,201
8000 FOR a=32000 TO 32335 STEP 4
8010 LPRINT a;" ";PEEK a;TAB 12;
PEEK (a+1);TAB 18;PEEK (a+2);TAB
 24;PEEK (a+3)
8020 NEXT a
8030 STOP
9000 LET sum=0
9010 FOR a=32000 TO 32335
9020 LET sum=sum+PEEK a
9030 NEXT a
9040 LPRINT "Chechsum =";sum
```

```
32000 175   55    24    1
32004 175   71    5     33
32008 126   92    126   230
32012 7     119   45    126
32016 230   248   79    126
32020 230   7     46    143
32024 87    126   230   248
32028 178   119   221   42
32032 123   92    221   9
32036 17    139   255   221
32040 25    33    224   90
32044 14    32    56    177
32048 92    214   192   48
32052 2     190   [illegible] [illegible]
32056 22    8     167   237
32060 66    146   46    251
32064 130   9     229   123
32068 33    224   87    88
32072 14    64    237   82
32076 145   48    251   129
32080 25    14    32    30
32084 9     29    237   66
32088 146   48    250   130
32092 9     184   40    5
32096 21    37    61    32
32100 251   56    176   92
32104 184   40    12    193
32108 35    3     214   8
32112 48    250   198   8
32116 43    11    197   79
32120 6     8     197   213
32124 229   121   221   70
32128 124   14    0     86
32132 35    94    221   102
32136 132   105   185   40
32140 15    203   56    203
32144 25    203   60    203
32148 29    203   35    203
32152 18    61    32    241
32156 229   33    126   92
32160 203   94    32    12
32164 184   40    2     203
32168 230   185   40    14
32172 203   238   24    10
32176 184   40    2     203
32180 246   185   40    2
32184 203   254   8     48
32188 28    8     221   126
32192 124   162   40    8
32196 203   214   203   70
32200 40    2     22    0
32204 221   114   132   225
32208 225   126   176   119
32212 35    126   177   24
32216 15    8     209   225
32220 120   47    70    160
32224 178   119   35    121
32228 47    78    161   179
32232 119   43    209   193
32236 221   43    21    40
32240 5     37    16    134
32244 24    28    5     40
32248 25    4     229   33
32252 126   92    203   222
32256 225   197   1     224
32260 6     29    40    4
32264 9     193   24    230
32268 6     255   9     193
32272 24    224   33    141
32276 92    8     48    2
32280 46    143   8     126
32284 46    126   209   203
32288 86    40    4     203
32292 70    32    28    1
32296 223   255   203   102
32300 40    1     18    19
32304 203   110   40    1
32308 18    235   9     235
32312 203   118   40    1
32316 18    19    203   126
32320 40    1     18    1
32324 0     6     8     56
32328 2     203   150   203
32332 86    200   12    201

Chechsum =34753
```

List remedy

Robert Pearlman, Winchmore Hill, London.

ZX-81

THE LIST routine provided by Sinclair in the ZX-81 ROM is inadequate for the serious programmer for several reasons: a long program must be listed in small sections using many List statements, which is time-consuming and leads to mistakes; the end of a very long line cannot be listed; after a Newline character in a line, which is common in machine-code programs, the rest of the line and the rest of the program are sometimes not listed. Finally, after a Chr$ 126, a common character in machine-code programs, the next five bytes are not listed.

These faults are remedied by my List routine. When executed, a screenful of text is scrolled up the screen and displayed. A small black square then appears in the bottom left of the screen indicating that the program is waiting for a key to be pressed, either Break to abort the listing, or any other key to continue.

The machine-code routine occupies 160 bytes and may be located anywhere in RAM because it uses no absolute addressing, a good place being in RAMtop or in a Rem statement. It can be entered using any of the hexadecimal loaders that have been in previous issues of *Your Computer*. It is executed by Rand Usr followed by the start address.

```
ZX81 machine code list
start
add.= hex                mnemonic          comment
 0000 1615               LD D,21
 0002 D5                 PUSH DE
 0003 010014             LD BC,5120
 0006 CDF508             CALL 2293         ;print at b,c (20,0)
 0009 217D40             LD HL,16509       ;beginning of program
 000C 46              NL:LD B,(HL)
 000D 23                 INC HL
 000E 4E                 LD C,(HL)
 000F CD980A             CALL 2712         ;print line no.
 0012 D1                 POP DE
 0013 1E16               LD E,22
 0015 D5                 PUSH DE
 0016 23                 INC HL
 0017 46                 LD B,(HL)
 0018 05                 DEC B             ;b is length of line -1
 0019 23                 INC HL
 001A 23                 INC HL
 001B AF                 XOR A
 001C 20EE       NEWLINE:JR NZ, NL
 001E 7E           START:LD A,(HL)
 001F FE7E               CP 126
 0021 2009               JR NZ, NOT.126
 0023 78                 LD A,B
 0024 010500             LD BC,5
 0027 09                 ADD HL,BC         ;jump over 5 bytes of data
 0028 91                 SUB A,C
 0029 47                 LD B,A
 002A 180C               JR SKIP
 002C CB77       NOT.126:BIT 6,A           ;see if chr$(a) is printable
 002E F5                 PUSH AF           ;preserve carry flag
 002F C5                 PUSH BC
 0030 C44B09             CALL NZ, 2379     ;expands chr$(a)
 0033 C1                 POP BC
 0034 F1                 POP AF
 0035 CC1000             CALL Z, 16        ;prints chr$(a)
 0038 23            SKIP:INC HL
 0039 3A3A40             LD A,(16442)
 003C FE03               CP 3
 003E 2051               JR NZ, NOSCROLL
 0040 D1                 POP DE
 0041 15                 DEC D
 0042 1D                 DEC E
 0043 AF                 XOR A
 0044 BA                 CP D              ;see if a pause is needed
 0045 2003               JR NZ, MISS
 0047 53                 LD D,E
 0048 1E22               LD E,34
 004A D5            MISS:PUSH DE
 004B C5                 PUSH BC
 004C E5                 PUSH HL
 004D 201E               JR NZ, NOPAUSE
 004F 2A0C40             LD HL,(16396)
 0052 11F802             LD DE,760
 0055 19                 ADD HL,DE         ;address for 23,0
 0056 E5                 PUSH HL
 0057 3680               LD (HL),128       ;print an inverse space
 0059 2A2540       PAUSE:LD HL,(16421)     ;last key
 005C 117FFD             LD DE,64895       ;code for 'break'
 005F A7                 AND A
 0060 ED52               SBC HL,DE
 0062 19                 ADD HL,DE         ;cp hl,de
 0063 CC0800             CALL Z,8          ;if break pressed then
 0066 0C                 DEFB 12           ;output error code D
 0067 24                 INC H
 0068 28EF               JR Z, PAUSE       ;halt program until key pressed
 006A E1                 POP HL
 006B 3600               LD (HL),0
 006D 2A0C40     NOPAUSE:LD HL,(16396)
 0070 E5                 PUSH HL
 0071 112100             LD DE,33
 0074 19                 ADD HL,DE
 0075 D1                 POP DE
 0076 01B502             LD BC,693
 0079 EDB0               LDIR              ;scroll a line
 007B AF                 XOR A
 007C 0620               LD B,32
 007E 13            LOOP:INC DE
 007F 12                 LD (DE),A
 0080 10FC               DJNZ LOOP
 0082 3A3940             LD A,(16441)
 0085 4F                 LD C,A
 0086 3E21               LD A,33
 0088 91                 SUB A,C
 0089 4F                 LD C,A
 008A 0614               LD B,20
 008C CDF508             CALL 2293         ;print at 20,c
 008F E1                 POP HL
 0090 C1                 POP BC
 0091 10BB      NOSCROLL:DJNZ START
 0093 3E76               LD A,118
 0095 D7                 RST 16
 0096 23                 INC HL
 0097 7E                 LD A,(HL)
 0098 FE76               CP 118
 009A 2080               JR NZ,NEWLINE ;if end of program then return to BASIC
 009C D1                 POP DE
 009D C9                 RET
```

Sprite write

Keith Berry, Birmingham.

ATARI

THIS PROGRAM is a utility for redesigning characters or players — sprites — without the need for graph paper.

```
100 REM PLAYER/CHARACTER DESIGN UTILITY
110 REM (c)  Keith Berry 1982
120 DIM R$(15):R$="PRESS  RETURN "
130 MARSET=480:CHST=710:GR3=650:GR=370:C
LS=840:LM=82:WHI=12:BLU=112:C1=1:C2=2:C3
=3:C6=6:C16=16:Z0=0
140 LKP=764:CUR=752:CR0=708:CR1=709:CR2=
710:CR4=712:GRAPHICS Z0:POKE CR2,BLU:POK
E CR1,WHI:POKE CUR,C1:POKE LM,C2
150 CS=125:BM=255:? "BINARY REPRESENTATI
ON OF DECIMAL NOS.":? ,"(c) K. Berry 198
2."
160 POSITION 8,11:? "DO YOU WANT INSTRUC
TIONS?"
170 Z=PEEK(LKP):IF Z=BM THEN 170
180 POKE LKP,BM:IF Z=35 THEN GOTO GR
190 GRAPHICS Z0:POKE CR1,C2:POKE CR2,WHI
:POKE CUR,C1
200 ? :? "Players for PLAYER-MISSILE GRA
PHICS orCharacters in a redefined charac
ter   set are constructed in rows o"
210 ? "BYTES each 8 bits wide.  Each bit
 is  turned on or not according to the n
o. that the byte holds."
270 ?
```

(continued on next page)

(continued from previous page)

```
280 ? "Designs can be planned on graph paper,adding each bit to obtain the decimal"
290 ? "number for each byte, but Mode 2 of   this program saves you this trouble.":?
300 ? "Mode 1 allows you to enter decimal    data and see the resulting character."
310 ? "In the case of a Player, you can see  the effects of increasing its width to";
320 ? "to double or quadruple size as allowedby Player-Missile Graphics."
330 ?
340 ? ,R$;
350 Z=PEEK(LKP):IF Z<>HHI THEN 350
360 POKE LKP,BM
370 GRAPHICS Z0:POKE CR2,BLU:POKE CR1,HHI:POKE CUR,C1:POKE LM,C2
380 ? :? "DESIGNING PLAYERS/CHARACTERS":? "IN BINARY DIGITS."
390 ? :? :? "SELECT:":? :? "[1] DESIGN FROM DATA":? :? "[2] DATA FROM DESIGN"
400 Z=PEEK(LKP):IF Z<>30 AND Z<>31 THEN 400
410 POKE LKP,BM:IF Z=30 THEN GOTO GR3
420 ? CHR$(CS);"HOW MANY LINES";:INPUT L
430 ? CHR$(CS)
440 ? "ENTER ";L;" NUMBERS (0 TO 255)":? :?
450 DIM X(L)
460 FOR A=C1 TO L:? A;": ";:INPUT B:X(A)=B:NEXT A
470 ? :? "WIDTH (1,2 or 4)";:INPUT R:IF R<C1 OR R>2 AND R<>4 THEN 470
480 POKE LM,15-R*C3
490 GRAPHICS Z0:POKE CR1,C2:POKE CR2,HHI:POKE CUR,C1:?
500 FOR A=C1 TO L
510 N=X(A):M=X(A)
520 Z=128:C=Z0
530 C=C+C1:IF C=9 THEN GOTO 560
539 REM THE * IN THE NEXT LINE IS AN INVERSE SPACE:
540 IF M>=Z THEN FOR P=C1 TO R:? "*";:NEXT P:M=M-Z:Z=Z/C2:GOTO 530
550 FOR P=C1 TO R:?." ";:NEXT P:Z=Z/C2:GOTO 530
560 ? " ";N
570 NEXT A:?
580 ? "CHANGE WIDTH (1,2 or 4)"
590 Z=PEEK(LKP):IF Z<>24 AND Z<>30 AND Z<>31 THEN 590
600 POKE LKP,BM:IF Z=31 THEN R=C1
610 IF Z=30 THEN R=C2
620 IF Z=26 THEN R=C3
630 IF Z=24 THEN R=4
640 GOTO MARSET
650 GRAPHICS C3:POKE CR0,22:POKE CR1,HHI:POKE CR2,BLU:POKE CR4,200
660 COLOR C1:PLOT 15,20:DRAWTO 24,20:DRAWTO 24,17:DRAWTO 15,17:DRAWTO 15,20
670 COLOR C2:FOR A=C1 TO 16:PLOT 16,A:DRAWTO 23,A:NEXT A
680 POKE LM,C1:? "DRAW YOUR DESIGN IN THE SPACE, USING  ARROWS,  SPACE ,  DELETE  & RETURN."
690 POKE CUR,C1:? "(No Shifts needed). WHEN YOUR DESIGN IS COMPLETE, PRESS  START  FOR READOUT.";
700 X=16:Y=C1
710 IF PEEK(53279)=C6 THEN GOTO CLS
720 Z=PEEK(LKP):IF Z<>C6 AND Z<>7 AND Z<>14 AND Z<>15 AND Z<>HHI AND Z<>33 AND Z<>52 THEN GOTO CHST
730 POKE 53279,20
740 IF Z=HHI THEN X=16:Y=Y+1:IF Y>16 THEN Y=16
750 IF Z=C6 THEN X=X-C1:IF X<C16 THEN X=C16
760 IF Z=7 THEN X=X+C1:IF X>23 THEN X=23
770 IF Z=14 THEN Y=Y-C1:IF Y<C1 THEN Y=C1
780 IF Z=15 THEN Y=Y+C1:IF Y>16 THEN Y=16
790 IF Z=33 THEN COLOR C3:PLOT X,Y
800 IF Z=52 THEN COLOR C2:PLOT X,Y
810 FOR H=C1 TO 20:NEXT H
820 IF PEEK(53279)=6 THEN GOTO CLS
830 POKE LKP,BM:GOTO CHST
840 ? CHR$(CS)
850 DIM X(16)
860 J=128:K=C16
870 FOR A=C1 TO 16:X(A)=Z0:J=128
880 FOR K=C16 TO 23
890 LOCATE K,A,P:IF P=C3 THEN X(A)=X(A)+J:J=J/C2
900 IF P=C2 THEN J=J/C2
910 NEXT K
920 NEXT A
930 ? "THE DATA FOR THIS DESIGN:"
940 FOR A=C1 TO 16:? X(A);",";:NEXT A:?
950 ? R$;
960 Z=PEEK(LKP):IF Z<>HHI THEN 960
970 POKE LKP,BM:R=C1:L=16:GRAPHICS Z0:POKE CR1,C2:POKE CR2,HHI:GOTO MARSET
```

Auto-list

S M Russell,
Lee,
London.

BBC

IT IS SOMETIMES useful to list part of a program automatically under the control of that program. For example, a program could give the option of changing the contents of its Data statements, and then list the relevant lines for alteration. Unfortunately, BBC Basic does not allow the use of the List command within a program. These subroutines overcome the problem.

ProcList scans the program in memory and, when it finds the required lines, sends each line number, its position in memory, and the line length to ProcDecode. ProcDecode first prints the line number, and then sends each byte of the line to a resident routine — located at &B53A — to be translated into a keyword if a token, or into ASCII if not. The result is then printed.

There is one limitation that ProcDecode does not translate the line numbers associated with Goto and Gosub correctly, because these use a special code.

When calling ProcList, the two parameters in brackets after the procedure name specify the first and last lines to be listed. If only one line is required, then set both parameters to that value. Line 10020 gives a demonstration.

These procedures may also be used in error-trapping routines, to display the offending line automatically; for example:

```
10 ON ERROR GOTO 10035
10035 MODE 7:REPORT:PRINT:PROClist
  (ERL,ERL):END
```

```
10000 REM SUBROUTINE TO LIST FROM WITHIN A PROGRAM (C) S.M.Russell 1983
10010 REM DEMO
10020 PROClist(10040,10120)
10030 END
10040 DEF PROClist(n1,n2)
10050 LOCAL length%,line_no%,start%
10060 start%=PAGE:@%=5
10070 REPEAT
10080   line_no%=start%?1*256+start%?2:length%=start%?3
10090   IF line_no%>=n1 AND line_no%<=n2 THEN PROCdecode(line_no%,start%,length%
)
10100   start%=start%+length%
10110   UNTIL start%?1=&FF:@%=&A0A
10120 ENDPROC
10130 DEF PROCdecode(line_no%,start%,length%)
10140 LOCAL A%,I%
10150 DECODE=&B53A:I%=4
10160 PRINTline_no%;
10170 REPEAT:A%=start%?I%:CALL DECODE
10180   I%=I%+1:UNTIL I%=length%:PRINT
10190 ENDPROC
```

Status

Colin Carruthers,
Edinburgh.

SPECTRUM

THIS PROGRAM was written on a 16K machine and will run in either 16K or 48K. It is a short three-line program which I called Status. When exectued it returns a number of useful pieces of information about the general status of the machine — program size, variable space and free space. I use it while developing other programs.

```
   1 DEF FN p(n)=PEEK n+256*PEEK (n+1)
9998 CLS : DRAW 255,0: DRAW 0,175: DRAW -255,0: DRAW 0,-175: PLOT 40,158: DRAW 127,0: PRINT AT 1,5;"Machine Status..";AT 4,2;"Total RAM         :";(FN p(23732)-16383)/1024;" K";AT 6,2;"Microdrive Maps:";FN p(23631)-23734;" bytes";AT 7,2;AT 8,2;"BASIC program   :";FN p(23627)-FN p(23635);" bytes";AT 9,2;"Variables        :";FN p(23641)-FN p(23627)-1;" bytes";AT 11,2;"Free Space       :";FN p(23730)-FN p(23641);" bytes";AT 19,2;"UDG:ABCDEFGHIJKLMNOPQRSTU"
9999 PRINT AT 14,2;"Up Time         :";INT ((FN p(23672)+65536*PEEK 23674)/50);" seconds": GO TO 9999
```

```
Machine Status..

Total RAM        :48 K
Microdrive Maps:0 bytes
BASIC program   :3977 bytes
Variables        :73 bytes
Free Space       :36024 bytes

Up Time          :180 seconds

UDG:AB♣♦EFG♥IJKLMNOPQR♠♛U
```

The wall

Robert O'Donnell,
Stockport,
Cheshire.

ZX-81

THE OBJECT of the game, which takes under 16K of RAM, is to catch 10 of the apples that are being thrown over the orchard wall. You steer the basket at the bottom of the screen using keys 5 and 8.

20 16 graphics shift A
50 16 inverse L
80 inverse L; graphics shift 8; two inverse spaces; graphics shift 5; inverse L
90 inverse L; four graphics shift 6; inverse L
3000 inverse L
3020 inverse star
9610 as line 9600 but inverse.

```
  10 FOR I=1 TO 10
  20 PRINT "▒▒▒▒▒▒▒▒▒▒▒▒▒▒▒▒";
  30 NEXT I
  40 FOR I=1 TO 34
  50 PRINT "LLLLLLLLLLLLLLLL";
  60 NEXT I
  61 POKE 16418,1
  62 PRINT "SCORE 0"
  70 LET BAT=15
  80 LET A$="█▀  ▀█"
  90 LET B$="█▄▄▄▄█"
 100 LET SCORE=0
 120 LET APPLES=0
 130 GOSUB 2030
 140 GOTO 9000
1000 PRINT AT 20,BAT;A$;AT 21,BA
T;B$
1010 LET BAT=BAT+(INKEY$="8")-(I
NKEY$="5")
1020 LET BAT=BAT-(BAT=27)+(BAT=-
1)
1030 RETURN
2000 LET APPLEY=APPLEY+1
2010 IF APPLEY<20 THEN RETURN
2020 IF APPLEX=BAT+3 OR APPLEX=B
AT+2 THEN LET SCORE=SCORE+1
2030 LET APPLEX=INT (RND*28+2)
2040 LET APPLEY=5
2045 PRINT AT 22,6;SCORE
2047 IF SCORE=10 THEN GOTO 9500
2048 LET APPLES=APPLES+1
2049 PRINT AT 22,15;"NUMBER: ";A
PPLES
2050 RETURN
3000 PRINT AT APPLEY,APPLEX;"█"
3010 GOSUB 2000
3020 PRINT AT APPLEY,APPLEX;"▣"
3030 RETURN
9000 GOSUB 1000
9010 GOSUB 3000
9020 GOTO 9000
9500 LET A$="WELL DONE, YOU HAVE
 CAUGHT TEN. "
9510 FOR I=1 TO 32
9520 FOR J=0 TO 4
9530 PRINT AT J,I-1;A$(I)
9540 NEXT J
9550 NEXT I
9560 LET A$=" HOWEVER YOU WASTED
 "+STR$ (APPLES-10)+" APPLES "
9570 DIM B$(LEN A$)
9580 LET X=15-LEN A$/2
9590 PRINT AT 11,X;B$;AT 13,X;B$
;AT 12,X;A$
9600 PRINT AT 22,0;"PRESS NEWLIN
E FOR ANOTHER GAME."
9610 PRINT AT 22,0;"PRESS NEWLIN
E FOR ANOTHER GAME."
9620 IF INKEY$="" THEN GOTO 9600
9630 CLS
9640 RUN
```

From the screen

Nigel Beasley,
Exeter,
Devon.

BBC

THIS PROGRAM is an assembly language program for a Model B BBC Micro with a printer interface and Epson MX-80 F/T 3 printer or similar. The final routine occupies about 250 bytes and is located at 10000 in the memory. Alterations may have to be made for other printers. This program takes about two minutes to print the entire screen, much faster than any Basic program.

In this way, graphics and text can be reproduced at the same time.

To use the program, type it in exactly as shown, leaving out any comments, if you wish. Comments follow an oblique sign. Run the program. If you are sure that no errors have occurred then type:

*SAVE"DUMP" 2710 2803 (Return)

This saves the area of memory where the program occurs. Also save the assembly language program as usual:

SAVE"ASSEMBL" (Return)

To use the routine in your programs simply use the Basic command:

CALL 10000

10000 is the memory location where the routine starts. When using the program it must be ensured that you do not overwrite it with a Basic program: Top must be below 10000. To reload the routine into memory having saved it under a particular filename use the command

*LOAD"DUMP" 2710

When reloading the program it will not disrupt any program already in memory, so it can be loaded into memory from a Basic program, using the aforementioned command.

To use with another printer: it must be a dot-matrix printer with bit image printing capabilities. The areas where specific commands for the Epson are shown and the commands for your printer can be inserted here.

```
 10 REM Assembly language program to dump screen onto printer
 20 REM For EPSON MX-80 F/T 3
 30 REM (c) N.Beasley 23/1/83
 40 CLS
 50 OSWORD=&FFF1
 60 OSWRCH=&FFEE
 70 P%=10000: REM Sets program counter **DO NOT CHANGE !!!**
 80 [
 90 LDA £2:JSR OSWRCH \ Turns on printer
100 LDA £1:JSR OSWRCH \ Sets the line spacing to 1/32 inch
110 LDA £27:JSR OSWRCH \ on an Epson
120 LDA £1:JSR OSWRCH
130 LDA £51:JSR OSWRCH
140 LDA £1:JSR OSWRCH
150 LDA £24:JSR OSWRCH
160 LDA £&1F \ Initialises Y value
170 STA &77
180 LDA £4
190 STA &78
200 CLC \ Start of main loop
210 LDA &77 \ Subtracts 32 from Y value
220 SBC £31
230 STA &77
240 LDA &78
250 SBC £0
260 STA &78
270 LDA £1:JSR OSWRCH \ Puts the Epson printer into
280 LDA £27:JSR OSWRCH \ 'Bit image printing' mode
290 LDA £1:JSR OSWRCH
300 LDA £76:JSR OSWRCH
310 LDA £1:JSR OSWRCH
320 LDA £128:JSR OSWRCH
330 LDA £1:JSR OSWRCH
340 LDA £2:JSR OSWRCH
350 LDA £&FF \ Initialses X value
360 STA &70
370 LDA £&FF
380 STA &71
390 .XCOOD \ Start of Xcood loop
400 CLC
410 LDA &70 \ Adds 2 to X value
420 ADC £2
430 STA &70
440 LDA &71
450 ADC £0
460 STA &71
470 LDA £252 \ Initiases Y movement value
480 STA &75
490 LDA £0 \ Initialises memory loacation to receive 'bit image'
500 STA &79
510 .YCOORD \ Start of search
520 CLC
530 LDA &75 \ Adds 2 to Y search value
540 ADC £4
550 STA &75
560 LDA &77 \ Put actual Ycood value into position ready for call
570 SBC &75
580 STA &72
590 LDA &78
600 SBC £0
610 STA &73
620 LDA£9 \ Sets A=9 for OSWORD call
630 LDX £&70 \ Points to locaton of memory where coords are held
640 LDY £0
650 JSR OSWORD
660 CLC
670 LDA &79 \ Takes present 'Bit image'
680 ROL A \ Rotates it left
690 ADC &74 \ Adds result of OSWORD call
700 STA &79 \ Stores result
710 LDA £27 \ Branches back if not finished
720 CMP &75
730 BPL YCOORD
740 LDA £1:JSR OSWRCH \ Sends result to printer
750 LDA &79:JSR OSWRCH
760 LDA £&FF \ Branches back to increase X value if not 1279
770 CMP &70
780 BNE XCOOD
790 LDA £4
800 CMP &71
810 BNE XCOOD
820 LDA £1:JSR OSWRCH \ Sends linefeed to printer
830 LDA £10:JSR OSWRCH
840 LDA &78 \ Branches back to decrease Y value if not 0
850 BNE &2800
860 LDA £31
870 CMP &77
880 BNE &2800
890 LDA £3 \ Turns off printer
900 JSR OSWRCH
910 RTS
920 ]
930 P%=&2800
940 [
950 JMP &273B
960 ]
```

Decimal liner

K W Hall,
Catterick Garrison,
North Yorkshire.

VIC-20

THIS USEFUL subroutine was written for the Vic-20 but can easily be modified for other micros. Anyone who writes programs and requires their outputs listed in columns will know that Basic does not line up decimal points. The following subroutine does just that. The subroutine expects the variables to be processed in X: the output is in X$.

```
8000 A$=RIGHT$("      "+STR$(INT(X)),4)
8030 B$=LEFT$(MID$(STR$(INT((X-INT(X))
        *100+.005))+"00",2),2)
8040 C$=".":X$=A$+C$+B$:RETURN
```

X string can now be Printed in a normal For loop Print routine. The spaces in line 8000 can be increased to adjust the position of the output on the screen. ■

COMPETITION CORNER

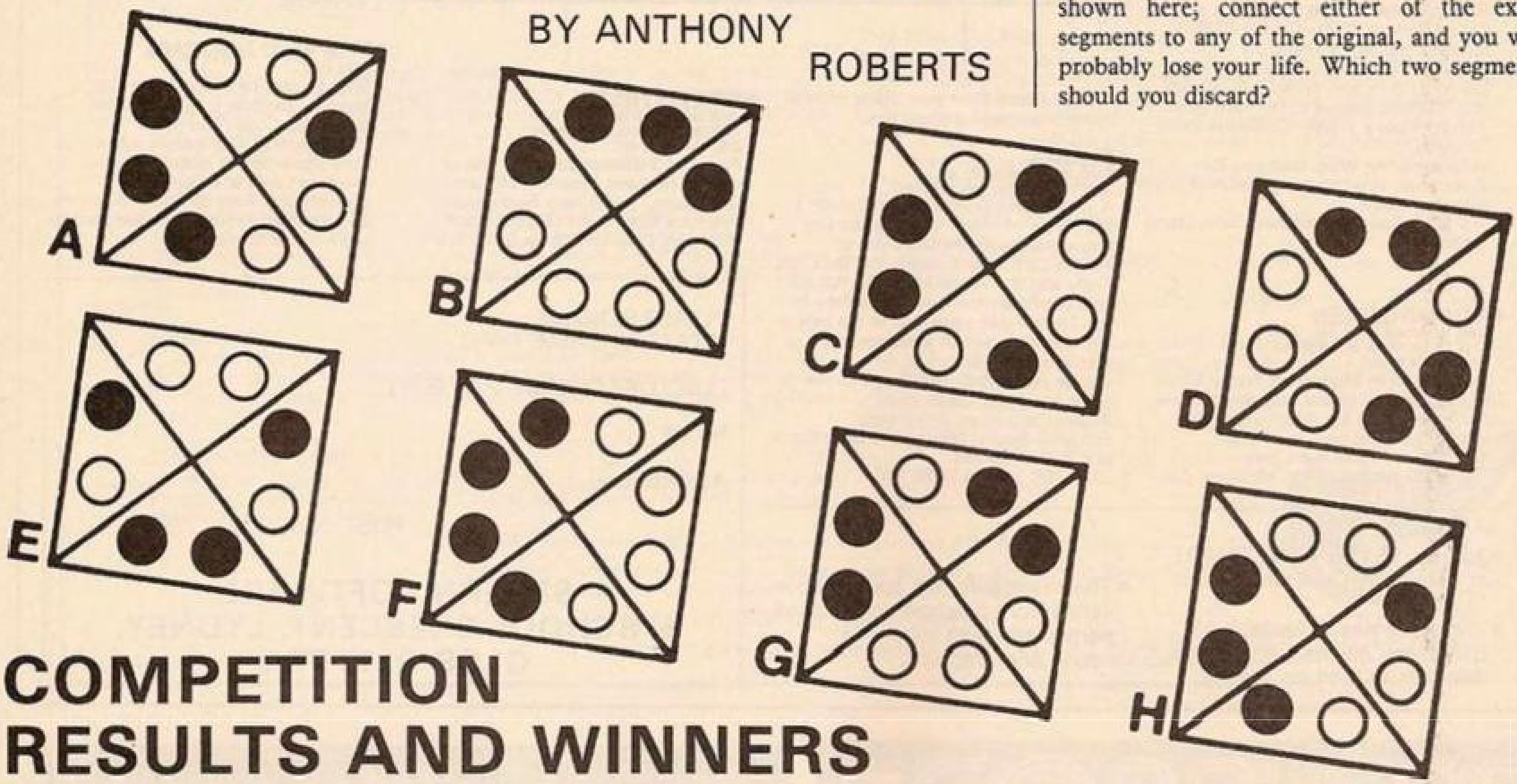
A £15 book token will be awarded to the first correct solution drawn from the competition bag. All entries must be at the *Your Computer* offices by the last working day in March. The name of the winner, the solution, and a competition report will be published in the May, 1983 issue of *Your Computer.*

If you want to set a competition for Competition Corner, remember that the simplest solution should be calculable by a short program rather than by any other form of reckoning.

TELEPATHIC DANGERS

BY ANTHONY ROBERTS

YOU HAVE found the fabulous cube of On'ey! However, as you approach, a careless thought triggers a circuit, and the cube tumbles apart into six regular square-based pyramids, and you know that you have just minutes to reconstruct it before the segments crumble to dust. Each segment connects to its neighbouring segments via a set of four lugs and four holes, two to each triangular face — each lug must match a hole on the next segment. As you gather the segments you notice that there are in fact the eight segments shown here; connect either of the extra segments to any of the original, and you will probably lose your life. Which two segments should you discard?



COMPETITION RESULTS AND WINNERS

JANUARY'S COMPETITION to win an Oric asked contestants to complete the crossword and the sentence, "My New Year should start with an Oric because . . .". If the number of entries for our competitions is any indication of how popular a new computer will be, the Oric should do well; but not as well perhaps as its closest rival, the Spectrum, which drew several hundred more entries last July.

The winning entry was a rather off-beat one from J Elliot, 1 Saint Mary's Road, Burgess Hill, West Sussex, who wrote "I got those ZX-81 — 16K — RAM-pack — wobble blues!". Unlike the ZX-81 the Oric, of course, keeps its memory tucked away inside the case. The ZX-81 also came in for a bit of stick from R Booth who said that "the Alsatian keeps mistaking my ZX-81 for a dog biscuit".

Quite a few readers showed their learning by making a play on the line from Hamlet, "Alas poor Yorick. . .". The best of these was P Douthwaite's "Alas poor Oric, I'd use him well, a computer of infinite jest". This is the one quote, incidentally, that everyone gets wrong. Look up your Hamlet and you will see that Hamlet says not, "I knew him well" but "I knew him Horatio". Neither version, however, is particularly relevant to the Oric.

N Dickason claimed optimistically that "with my Oric promotion will be meteoric", while S Yeo revealed "my wife has run off with the Sinclair". From A Cutler came "it would provide the Basic necessities for life . . . and many other games".

Finally, G Towner's entry raised the big question hanging over Oric International — can it deliver? He pointed out that his New year should start with an Oric because "it will be over 28 days since I ordered one".

A number of correct solutions were sent in for the Star Stone competition but few were accompanied by a program. Admittedly the problem did not lend itself to a short program solution. To find the answer you needed to work out that there are only three faces on the Stella Octangular which cannot form part of a closed loop. Between them they contain one tetrahedroid crystal, three pan-metallic hypercubes and five spheroid diamonds.

The £15 book token goes to the first correct entry picked from the bag which was from P Carlotti, Hope Paint House, Granville Road, Kingsdown, Deal, Kent. ■

The solution to January's crossword when a prize of an Oric 1 was at stake. Although swarms of aspiring Oric owners came forward, the level of entries failed to match last July's competition with its prize of a Spectrum.



abacus electronics — ZX 81 Spectrum

MONEY BACK GUARANTEE
CASSETTES DESPATCHED
WITHIN 48 HOURS

ABACUS CONTROLLER

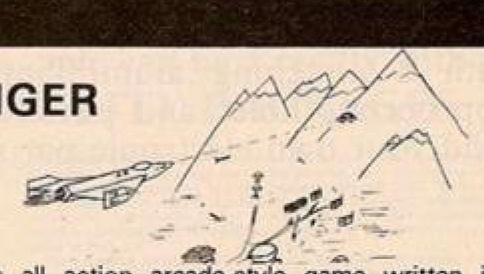


Of all the Spec H/W items I have received this one most impressed me and its the only one I shall always use.

Developed to eliminate tedious swapping of plugs when LOADING or SAVING programs on cassette.
ZX SPECTRUM CONTROLLER: Single switch selection of SAVE, LOAD & AMP modes. Built in amplifier and loud-speaker boosts Spectrum sound output. Price **£14.95**
ZX81 CONTROLLER: Single switch selection of TALK, SAVE, CUE & LOAD modes. Built in microphone/speaker for fast and reliable program naming and cueing. Price **£9.95**

All items in this advertisement can be viewed before buying at the Buffer Micro Shop, London, and Jay Dee Communications, Water Street, Port Talbot.

AVENGER

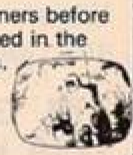


AVENGER: This all action arcade-style game written in MACHINE CODE for the ZX Spectrum is fantastic! You are flying over a mountainous planet terrain. Your mission is to attack, using lasers and bombs, launch pads, buildings and missile silos. Alien craft attack you with missiles; guided missiles launched from the ground hunt you out. But what ever you do don't hit the atomic power stations!! Continuous display of time, score, shields and laser temperature. Five levels of play and high scores.
Price **£4.95** inc. Also available for the ZX-81 (16K) at **£4.95** inc.

Available at W.H. Smiths

SPECTRUM GAMES PACK 1



DESTROYER: Listen to the beeps of the sonar to locate and destroy the submarines before they sink the merchant ships.
ICEBERG: Steer your icebreaker through thickening pack ice to pick up survivors.
BATTLE: Destroy missile sites while avoiding mines and the computerised enemy tanks that are out to get you.
ANDROID PIT RESUCE: Rescue the miners before they are trapped in the flooding mines.

All four on one cassette at the incredible price of £4.95 inc.

Access

186 St. Helens Ave,
Swansea, W. Glam.
Tel: (0792) 50282

H&H SOFTWARE

Alphabeta

A complete word processing package for the BBC Computer.
New revised version incorporating:

- faster printing
- compatibility with a range of printers including Seikosha, Epson and daisywheels. Versions for other printers on request.
- manual
- labels for the red keys
- automatic wrapround
- insert and delete (with gap closure)
- centring
- tabs
- right justification
- automatic word count
- merging
- double width characters
- bulk movement of text

and a host more features.

REVIEWS
Laserbug: "The program did work well and once you are used to it, writing letters etc., becomes very easy. I was inpressed with it in general and would buy it myself."
Acorn User: "Remarkable value — a complete word processing package for less than £30 . . . a useful and relatively inexpensive program."

ALPHABETA £28.50 including postage etc.
Please send orders and cheques/PO/Transcash (No. 614 131 1707) to:

H&H, Dept A, 53 Holloway, Runcorn, Cheshire.

Send S.A.E. for a catalogue of our other educational and games programs for the BBC and Dragon Computers.

CompUtopia LIMITED

At last — a printer for every Pocket!

MICROMAX — SPECIAL
INTRODUCTORY OFFER
ONLY £69 + VAT

SPEED SELECTABLE . . . .
SERIAL OR PARALLEL
INTERFACES AND CABLES
AVAILABLE FOR:
SINCLAIR ZX 81
SPECTRUM
VIC . . . DRAGON ETC . . .

UP TO 24 STANDARD OR
ENHANCED CHARACTERS
PER LINE . . . .

s.a.e. please for details to 30 Lake Street
LEIGHTON BUZZARD Beds Tel 0525 376600

EXPAND YOUR VIC 20

with a matching aluminium plinth with appropriate holes and power supply cover (add your own electronic parts)



£21
incl. p&p
& VAT (UK only)

Send cheque or P.O. with order delivery 2 - 3 weeks

We are manufacturers of electronic sheet metalwork and can supply any chassis to your own drawings.

M. GEAR (ENGINEERING) LIMITED, 179A VICTORIA ROAD, NEW BARNET, HERTS, EN4 9PA

LEON NOEL

ZX81 16K — GAMES ON TAPE

- ☐ **BANK ROBBER £4.50**
  SEE HOW MUCH MONEY YOU CAN ACCUMULATE BEFORE YOU'RE CAUGHT AND SENT TO JAIL
- ☐ **PONTOON £4.50**
  CAN YOU GET YOUR COMPUTER TO OWE YOU MONEY, NOT EASY, BUT IT CAN BE DONE
- ☐ **HANGMAN £4.00**
  WITH THIS EDUCATIONAL GAME YOUR COMPUTER WILL HAVE 150 WORDS TO CHOOSE FROM
- ☐ **CASSETTE COVER £4.00**
  PUT YOUR ZX PRINTER TO WORK AND MAKE YOUR PROGRAM COLLECTION LOOK IMPRESSIVE
  *CHOICE OF SIX COVER PATTERNS

PLEASE TICK APPROPRIATE BOX(S)

MAIL ORDER ONLY
NAME. . . . .
ADDRESS . . . .
. . . .
. . . . CODE . . . .

I enclose Cheque/P.O. for £. . . . .
Made payable to:

LEON-NOEL
24 Dudgeon Drive, Littlemore Oxford
OX4 4QL

ALL PRICES INCLUDE P&P, UK ONLY

THE GREATEST PROGRAMMING AID SINCE FINGERS

NEW



Cuts Down Program Entry Time

- *How many hours do you spend de-bugging programs?*
- *How many times have you traced a bug to a typing error?*
- *How many times have you wished for another pair of hands to keep your place in program listings?*
- *How many times have you had back-ache, neck-ache and eye-strain through copying listings at uncomfortable angles?*

THE EASIREADER FROM BUGBEAR

Saves Hours in De-bugging time

- Over 99% of bugs in programs copied from printout listings are the result of entry errors — errors anyone with only one pair of hands can make. Even one mistake can take hours to trace.

The EASIREADER Minimises Bugs by Minimising Entry Errors

- The attractive perspex stand can be positioned where most comfortable, avoiding stiff necks and aching backs... strain causes mistakes!
- The specially designed cursor prevents skipping between complicated and similar-looking lines while allowing you to 'read through' simple lines.
- The **EASIREADER** keeps your place for two-handed keyboard entries, i.e. when using a Sinclair computer or just using the 'shift' key.
- It will even scan the off-horizontal listings found in many magazines.
- The **EASIREADER** can handle all normal magazines up to A4 size, single sheets, computer printouts and most books.

HELP BANISH BUGS
Make your programming easier and more comfortable.
SAVE TIME AND EFFORT - AVOID FRUSTRATION

Send for your **EASIREADER** now at a special introductory price of **£12.99**. Please add £1.25 p&p.

BUGBEAR, DEPT. YC ? , NICHOLSON BUILDINGS, TEMPLETOWN, SOUTH SHIELDS, TYNE & WEAR NE33 5RZ.

© BUGBEAR 1982 Patent Pending No. 8232718

MEMORY DEVICES FROM:

GCC ELECTRONICS

Tel: 0223 835330 Telex: 817672

EPROMS		6500 Family		MEMORIES	
2708	200p	6502	375p	2114LP-2	90p
2716+5V	200p	6520	285p	2114-450	85p
2732	385p	6522	375p	4116-150	90p
2532	365p	6532	520p	4116-200	88p
2764	**6.80p**	6545-1	900p	4816-2+5V	250p
				4164-200	410p
6800 Family		**Z80 Family**		6116-150	350p
6800	270p	CPU	315p	5516-250	635p
6802	325p	ACPU	350p		
6810	110p	CTC	270p		
6809	850p	ACTC	290p		
6850	135p	PIO	340p		
6821	110p	APIO	350p		

We supply 74LS TTLs, CMOS 4000 Diodes. Transistors, etc., etc. All components are guaranteed prime parts, from leading manufacturers.

Orders from Government, Educational and Overseas buyers welcome. Special prices for volume enquiries. Please add post and packing plus VAT at 15%. Minimum order £15.00.

GCC ELECTRONICS
66 HIGH STREET, SAWSTON
CAMBRIDGE DB2 4BG
TEL: 0223 835330 TELEX: 817672



YOUR COMPUTER BACK ISSUES

Just getting started in computing? Or perhaps you're already pretty knowledgeable and would like to extend your programming skills. Either way Your Computer back issues can help to fill your need for reliable and, above all, relevant information about home computing.

Every issue contains reviews of new computers, software evaluations, and surveys of add-on equipment together with informative articles which tell you how to get to grips with graphics, sound and machine code programming.



To obtain any of these back issues please complete and return the coupon printed below. Prices per copy including post and packing are: United Kingdom: £1.50. Europe: £2.00. Rest of world: £2.50 (by Air Mail)

Facilities provided on the Sinclair ZX81 and Spectrum, Vic 20, Acorn Atom and BBC micro have been examined in article after article, providing a comprehensive introduction to all the most popular home computers. Just run your eye down the Contents of our back issues and you'll see what we mean.

To order back issues complete the coupon at the foot of this page and send it with your remittance to the address shown on the coupon.

January 1982
Reviews: BBC micro; Wordprocessing on Atom; Morphy v. Champion (chess computers). Game — Treasure House. Education — ZX81 programs for school use. Vic-20 Software. ZX81 Graphics. A-D conversion. Interview — Kenneth Baker.

February 1982
Survey: [illegible] BBC [illegible]ics. ZX8[illegible]cs. Vic 20 [illegible] How [illegible]gs. Atom P[illegible] on Z[illegible]err Borland.
SOLD OUT

April 1982
Survey: ZX Ports. Sorting on ZX-81. BBC Graphics. How to write an Adventure Game. Atom line labelling. Game — Nim for ZX81 and Apple II. Interview — John Baxter.

May 1982
Survey: ZX Software. How to write a chess program. Games — Vic 20 Tank Battle; Magic Squares. How to show off your ZX81. Joysticks for the ZX81. BBC Graphics. How to write a word processing package. Interview — Richard Turner.

June 1982
Reviews: Sinclair Spectrum; Vic 20 Software; ZX-81 Keyboards. Games Vic 20 Mars; Othello on Flexidisc. Atom Utilities. ZX81 machine code monitor. How to build a portable computer. Interview — Ron Bissell.

July 1982
Survey: Atom Software. Spectrum Graphics. ZX-81 Colour Board. Games — Dog Race; Genie Guessing Game; Simon Challenge. BBC Sound. ZX-81 Dis-assembler. Programs for ZX-80. Interview — Richard Altwasser.

August 1982
Review: Dragon 32. Survey: Vic memory expansion. Spectrum Sound Games — Demon's Domain; Vic Duck Shoot. ZX-81 machine code (Part 1). Atom file handling. Ecological modelling. BBC techniques. Interview — Tony Baden.

September 1982
Review: NewBrain. Spectrum Software. Sound on ZX-81. Games — Vic Dambuster; B-52 Bomb Run. Vic-20 Assembler. Spectrum Disassembler. ZX-81 Indexer. ZX-81 machine code (Part 2). Midwich MC control computer. Interview — Hermann Hauser.

October 1982
Reviews: Sanyo PHC range; MPF-II; Commodore 64; Colour Genie. Survey: BBC Software. Atom Forth. Pascal for Basic users. ZX word processing. Games — ZX-81 Pinball; Vic Catacombs. Atom text. BBC control Key. Spectrum Assembler. ZX-81 machine code (Part 3). Interview — Douglas Adams.

Issue (month)	Year	Quantity required

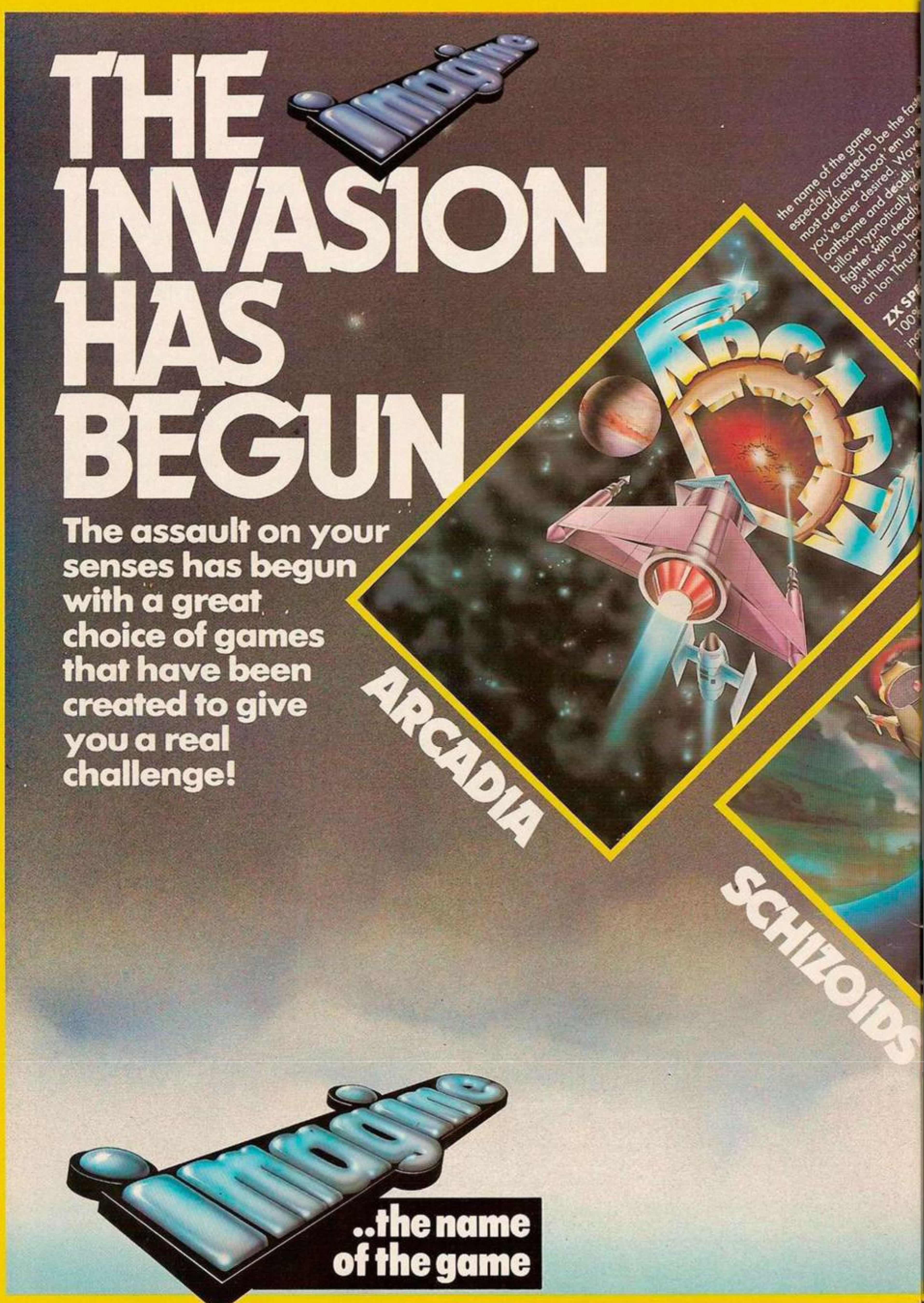
To: General Sales Dept., Room 108, IPC Business Press Ltd., Quadrant House, The Quadrant, Sutton, Surrey SM2 5AS.

Please send me the back issues detailed left – for which I enclose cheque/PO for £ .... payable to IPC Business Press.

Name ....

Address ....

....


THE imagine INVASION HAS BEGUN
The assault on your senses has begun with a great choice of games that have been created to give you a real challenge!
ARCADIA
SCHIZOIDS
imagine
..the name of the game


, meanest,
ne.
ter wave of the most
ns
rds your space
ent.
dual Plasma Disruptors and
ve haven't you?
TRUM (16K or 48K)
machine code with 12 different alien types,
ible animation and explosive effects, sound and the
est, smoothest hi-res graphics ever!
VIC-20 (any memory size)
100% machine code with eight different alien types,
smooth hi-res multicolour graphics and animation, narrow
playfield and sensational sound effects.
Keyboard or joystick.
Game design and software by D. H. Lawson.
for any ZX SPECTRUM.
It's my own fault, I even volunteered.
I thought that with the space-dozer and its shovel and skyhook
it would be easy shifting the galaxy's rubbish.
Childs play. HUH! They warned me of the weird packaging,
the trays, the rods, and all the rest.
But they didn't say I'd have to stop and control not just one but two
or even more garbage pods. Then prod them, push
them, toward that black hole, and oh, it's so very, very
black, and so lonely, so empty.
Panic, mustn't panic, but they won't stop, twirling and
spinning and turning, always turning, towards me, against
me, at me. And I'm alone.
No way out, nowhere to hide, on my own, my own... own ...
SCHIZOIDS: NOT JUST A GAME, BUT A STATE OF MIND.
SCHIZOIDS features real-time animated 3d graphics for a
breathtaking visual experience, plus sound and all those arcade
features you'd expect from IMAGINE.
Game design and Software by Peter Paranoid and
the Yid Kids. (D.H.L.)
the wildest, zaniest way of earning a
fast buck. With crazy guests screaming for
service you're gonna have to be
quick to pick up the tips, don't slop the drinks,
as you dodge the drunks and
dart from elevator to elevator, coz if the Boss
man spots you, your gonna be
out on your but. 100% machine code,
incredible animation, super smooth hi-res
multicolour graphics, authentic
sound effects and special playfield.
Keyboard or joystick control.
Yet another high performance
Arcade quality experience
for any Commodore
Vic-20.
Game design and
software by
Eugene Evans.
Wacky Waiters
WACKY
WAITERS



...'s a hectic
...fighter when
...children and return
...d handbags to the
... Of course one can
...sional bungling shoplifters
...bomb to add to the fun and
...A SNATCHA brings to your
...creen the mad, mad world of the
...re detective in what has to be the most
chaotic super store ever built with hordes
of harassed housewives doing their
weekly shopping. And you just wait till
the late-night shopping starts.
CATCHA SNATCHA features smooth
Hi-Res multicoloured graphics, sound,
multiple playfields and a real time clock.
100% machine code. Keyboard or
joystick.
Game design and software by
Eugene Evans.
for any Commodore Vic-20.
for any ZX SPECTRUM.
Are you just the average teddy.
Are you teddy enough to
take on the terrors of the
toybox in an epic struggle to fulfill your
true role in life – to reach and comfort your
crying baby? To boldly go where no teddy
has gone before. To overcome incredible
odds, to take on and fight the clockwork
soldiers, the mammah dolls, the train set, the
play people, and the murderous plastercine.
With only the bear essentials – your
wellington boot, your beachball and faithful
old peashooter – for your defence and your
only ally the Jack in the Box, you will need
to build stairways from the play bricks
around you to reach your baby without
getting the stuffing knocked out of you.
AH DIDDUMS features multiple
toyboxes with progressive difficulty
levels, super cute – super detailed
animation, sound and those fast
smooth graphics that only
IMAGINE can produce.
100% machine code.
Game design
and software by
D. H. Lawson.
Ah diddums
Post coupon now to Imagine Software, Masons Buildings,
Exchange Street East, Liverpool, Merseyside L2 3PN.
Please rush me copies of (tick box)
Arcadia Schizoids
Ah Diddums
(for any ZX Spectrum)
Arcadia Wacky Waiters
Catcha Snatcha
(for any Commodore VIC-20)
Please debit my Access/Barclaycard (delete as necessary)
Card Number
I enclose Cheque/PO for £
Name
Address
YC3
Access
SUPERFAST CREDIT CARD SALES LINE:
051 236 6849 (24hrs)
BARCLAYCARD VISA
e
e
, Merseyside L2 3PN.

ELECTRONIC

klik keyboard

AN ALTERNATIVE
NOT AN ADD ON



Installed in 3 easy steps . . .

1. Peel off the touch sensitive key pad.
2. Plug in Klik-Keyboard (no soldering) and place in position.
3. Apply self adhesive two-colour legends to the keys.

This full 40 key keyboard has a positive click feel as the keys are depressed but as it replaces the original touch pad it becomes a permanent part of the ZX81 without bulky boxes or trailing wires.

Other useful peripherals available from Kempston:-

SPECTRUM

NEW Competition-Pro Joystick £25.00
NEW Centronics Printer Interface .... around £35.00
24 Line Programmable User Port £18.95

Full range of Spectrum software – details on request.

KEMPSTON MICRO ELECTRONICS

180a Bedford Road, Kempston, Bedford, MK42 8BL.

I wish to order:

Quantity	Item	Price
	Post & packing 1 item £1.00, 2 or more items £2.50.	
	Total (VAT inclusive)	

Cheques/Postal orders should be made payable to Kempston (Micro) Electronics.

Name ____________________

Address ____________________

Post to Kempston (Micro) Electronics, Dept YC3
180a Bedford Road, Kempston, Bedford MK42 8BL

THE PROFESSIONAL APPROACH TO

SPECTRUM

SOFTWARE

We are a well established software company expanding into the field of Personal Computing.

ENHANCE YOUR BASIC

Now available BASIC toolkit includes:

- Add logical arithmetic functions (AND, NOT, OR, XOR)
- List all BASIC variables and arrays
- Speed up your games with our fast screen output.
- Renumber your program (including GOTO and GOSUB)
- All routines in machine code
- Easily called from BASIC
- Fully documented
- Runs on 16K and 48K SPECTRUM

£9.95 inc VAT (+ £1 p. & p.)

To order or to obtain details of our other products contact:

Malva Ltd.

**70 ASHCHURCH DR.
WOLLATON
NOTTINGHAM
NG8 2RA**

REAL TIME SOFTWARE SPECIALISTS

ZX81 CONTROL & MONITOR SYSTEM

24 CHANNEL COMMAND CENTRE

An exciting new concept in computer control with 24 independent channels operated by simple PEEK & POKE commands from the ZX81. Allows extensive control of all kinds of appliances and monitors their response. Superbly designed and engineered with extensive filtering circuiting protecting your ZX81.

COMMAND MODULES

A varity of control or monitor modules may be added to the command centre with its own indicator LEDs recording the current channel states. Comprehensive programs are easily constructed and checked because you can see the state and response of each channel.

1001 APPLICATIONS:

DOMESTIC: Control and Monitoring of appliances, heating, lighting models + security systems.

COMMERCIAL: Atuomatic test equipment, office equipment, electric surveillence FIRE/DOOR/INTRUDER monitoring laboritory applications.

INDUSTRIAL: Process control, level monitoring, detection and robotic/workshop applications.

Complete with manual and excellent security program giving operation to BS 4737.

SIMPLE TO INSTALL & USE, JUST PLUGS INTO ZX81 PORT: DOES *NOT* AFFECT RAMPACK or PRINTER.

QTY	DESCRIPTION		TOTAL
	24 CHANNEL COMMAND CENTRE CASED	£34.95	
	UNCASED	£19.95	
	PLUG IN 4 CHANNEL SOLID STATE MONTIRO MODULE	£6.50	
	PLUG IN 4 CHANNEL RELAY CONTROL MODULE	£7.50	
		P&P 1.95	

Please send cheque/postal order to Next Computer Systems for £......

Availible for Spectrum, Jupiter Ace + other computers shortly, send for details.

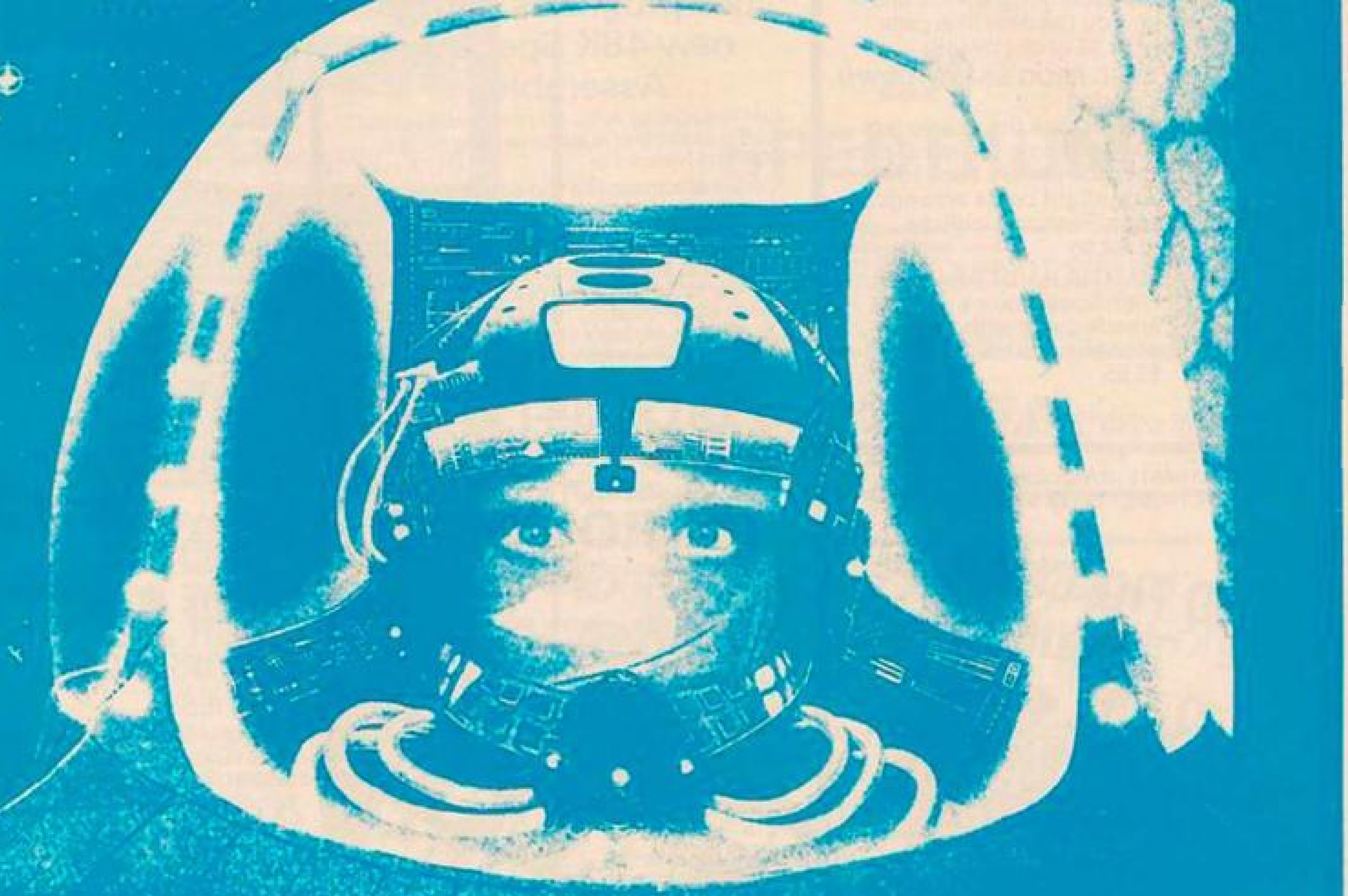
**NEXT COMPUTER SYSTEMS,
88 Harvest Road, Englefield Green,
Surrey, TW20 0QR**

6th ZX MICROFAIR
FEBRUARY 19th
NEW HORTICULTURAL HALL
LONDON SW1

SOFTEK

48K ZX Spectrum
COMPILER

£14.95



OUT OF THE BLUE . . .

Come three awesome additions to the Softek range of Sof$_{TM}$ Ware.

SOFMON

The ultimate monitor/disassembler/machine code loader for the ZX Spectrum. Sofmon has 25 functions, including modify in HEX or ASCII, move blocks, delete or insert bytes, HEX-DEC and DEC-HEX conversion, fill, display registers and nine breakpoints! And uniquely, as you enter HEX Sofmon will instantly do a full disassembly into Z80 mnemonics! Almost like having an assembler. For 16K or 48K Spectrums, only £9.95 including manual. This program is way ahead of all competition.

SOFKIT 1 – A full programmer's aid

This toolkit has every feature you could ever need. The fullest renumber routine available, covering GOTOs, GOSUBs, RESTORE and LINE. Search-and-replace any character, keyword, etc. Delete program lines singularly or in blocks. Display the variables, and list all lines containing any given character, phrase or keyword. It even offers the only TRACE facility for the Spectrum! Ideal for developing programs to be compiled as it removes REMs, changes lower to upper case (and vice versa) and displays program length. Incredible volume at £9.95 including manual. (16K or 48K Spectrums).

SOFKIT 2 – The complete graphics kit

This astounding program offers instant changing of INK or PAPER, pixel or characters scrolling (the fastest available), colour scrolling, PAINT, separate 'windows' which can be scrolled independently, characters printed with user defined vertical and horizontal magnification. It even allows storage of 'screens' in memory for cartoon effects, and the creation and display of Sprite-like graphics. Designed to work with our compiler, this kit is unbeatable at £9.95 (16K or 48K Spectrums).

These new additions to our range, as well as our best selling Meteoroids, Softime, Zolan Adventure and 3D Mazenture/Dragon's Lair, are available from your local software outlet. If not, let us know! If you can't get our Sof$_{TM}$ Ware locally write to us at:

SOFTEK SOFTWARE, 329 CROXTED RD., LONDON SE24

WANTED, GOOD M/C PROGRAMMERS FOR SPECTRUM, BBC, DRAGON, VIC, ETC.

GENEROUS DEALER DISCOUNTS

Push your Sinclair to the limit

ZX81/SPECTRUM ARCADE GAMES

NEW **ZX INVASION FORCE** (ZX81)
Use your skill to fire through the energy band to destroy the menacing alien ship — **£3.95**

NEW **SPEC INVADERS**
SPEC GOBBLEMAN
These exciting high-speed classic games incorporate hi-resolutiongraphics and sound to bring you the best in arcade action at only **£4.95** each (16/48K)

NEW **SPEC FROG 5/SHOWDOWN** (16/48K)
Hop across the dangerous road avoiding the lethal cars, then lorries. Go back to the wild west for a gunfight battle amongst cacti and wagons. Features include western music. **£4.95**

NEW **NAMTIR RAIDERS** (ZX81)
High speed, quick action arcade game with four separate groups of attackers. **£3.95**

Gobbleman also available for ZX81 at **£3.95**

UTILITIES

NEW **TOOLKIT**
Nine powerful new functions for your ZX81 (including re-number lines (goto, gosub), program merge, string finding and replacement. **£5.95**

SPEC BUG
A 30 in 1 machine code tool and disassembler for your ZX Spectrum. **£6.95**

ZX BUG
A 30 in 1 machine code tool and disassembler for your ZX81. **£6.95**

Improve your machine code programs with this new 48K Spectrum Assembler

Just released by Artic, this new professional quality assembler is also available for 16K ZX81 and features:—

* Word-processor-like text editor. * High-speed, versatile two-pass mnemonic assembler with labels and detailed error-trapping. Will assemble to any address. * Essential support facilities such as memory-edit, register inspect/modify and search for de-bugging. * Full output to ZX-printer. * Memory-status report and comprehensive user-manual.

ONLY **£9.95**

ZX81 & SPECTRUM

NEW LOW PRICE ADVENTURE GAMES

ONLY £5.95 for ZX81 and £6.95 for SPECTRUM

INCA CURSE (Adventure B)
In a jungle clearing you come across an ancient Inca temple. Your mission to enter, collect the treasure and escape alive. But beware! Includes a cassette save routine.

SHIP OF DOOM (Adventure C)
You are unavoidably drawn to an alien cruiser. Can you reach the control room and free yourself? Or will they get you first? Includes a cassette save routine.

ESPIONAGE ISLAND (Adventure D)
While on a reconnaisance mission your plane loses control and you are forced to land. Can you survive and escape with the island's hidden secret?

PLANET OF DEATH (Adventure A) 16/48K
You find yourself stranded on an inhabited alien planet. Can you reach your ship and escape?

also available for SPECTRUM

ZX FORTH
Supplied on cassette with editor cassette, user manuals and keyboard overlay. ZX Forth combines the simplicity of basic with the speed of machine code now **£14.95**

THE ULTIMATE ADVENTURE FOR THE SPECTRUM/ZX81 for only £9.95

AND THE CHANCE TO WIN £10,000 or more IF YOU KRAKIT™

RULES AVAILABLE FROM ARTIC

Your eccentric father has left you £10,000 in his will. In order to claim your windfall you must solve twelve clues and gain access to a bank account in which the money has actually been deposited. Be the first to crack the puzzle and the prize is yours! Plus you will win two tickets to the city of the secret KRAKIT™ vault location. The Prize money is increased weekly. A telephone number will be supplied so you have the opportunity to find out just how much you could win.

DON'T MISS YOUR CHANCE TO WIN A FORTUNE!

SPECTRUM MICRO CHESS

The only Chess program for a 16K or 48K Spectrum. Allows all legal moves, castelling; en-passant and pawn promotion. Options to play black/or white. Sets board in any position. Full colour and graphics display.

ONLY **£6.95**

new releases for 16K & 48K SPECTRUM

SPECTRUM INVASION FORCE

A popular arcade game for 16K or 48K Spectrum. Fires through the force field to destroy the menacing alien ship. Sounds easy?? Two levels of play — normal or suicidal. Full colour. Sound and hi-res. graphics.

NOW ONLY **£4.95**

A GREAT CHESS GAME FOR YOUR ZX81 OR SPECTRUM*



*SPECTRUM CHESS 48K

ZX CHESS I
Very popular machine code program, with six levels of play and an analysis option. Available for ZX81. **£6.50**

ZX CHESS II
A new improved version, with a faster response time, seven levels of play, analysis option and in addition a recommended move option. **£9.95**

ZX 1K CHESS
An incredible game in 1K for only **£2.95**

As featured on ITV

NEW **SPECTRUM VOICE CHESS**

This incredible program talks you through your game. It tells you its move, recommends a move, and contains a range of facetious comments. The game is based on the highly successful ZX Chess II and is offered at the Christmas offer price of **£9.95**.

SPECTRUM CHESS now only **£9.45**

ALWAYS AHEAD WITH ZX81/SPECTRUM SOFTWARE

Cheques & P.O. made payable to: Artic Computing Limited. Dealer enquiries welcome.
Please state whether your order is for ZX81 or Spectrum. Send S.A.E. (6in × 9in) for catalogue.

VISA

ARTIC COMPUTING LTD.
396 JAMES RECKITT AVENUE,
HULL, N. HUMBERSIDE.

To: Artic Computing Ltd., 396 James Reckitt Avenue, Hull, N. Humberside, HU8 0JA.

Please supply ....

....

Cheque for total amount enclosed.

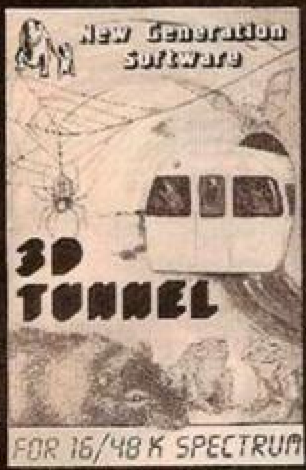
Name ....

Address ....

YC 3

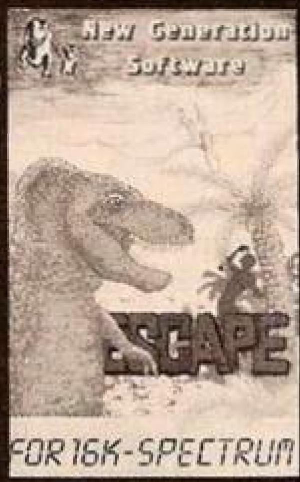
New Generation Software

From M. E. Evans the author of the highly acclaimed 3D MONSTER MAZE and 3D DEFENDER



3D TUNNEL (16K & 48K Versions on one tape)
What lies in the depths of the tunnel? Flapping bats, leaping toads, scurrying rats, crawling spiders, all appear live in the 3D TUNNEL as it weaves about. We leave the last object to your imagination. (Not in 16K version). Price £5.95, special introductory offer at £4.95 until February 28th.

TWO 3D GAMES FOR THE SPECTRUM



ESCAPE (requires only 16K)
Can you eascape from the dinosaur infested maze? 3D grandstand view provides dinosaurs with the opportunity to hide behind the hedges or to soar over them to swoop down on you. "One of the best and most original games we have seen for the Spectrum so far". SINCLAIR USER. Price £4.95

For instant CREDIT CARD Sales by phone only ring 01-930-9232
Orders to: NEW GENERATION SOFTWARE dept YC FREEPOST (BS 3433) (no stamp required in UK) OLDLAND COMMON, BRISTOL BS15 6BR

Please send s.a.e. with all enquires and for lists of stockists. TRADE ENQUIRIES WELCOME AT ADDRESS ABOVE.

SPECTRUM SOFTWARE FROM OZ

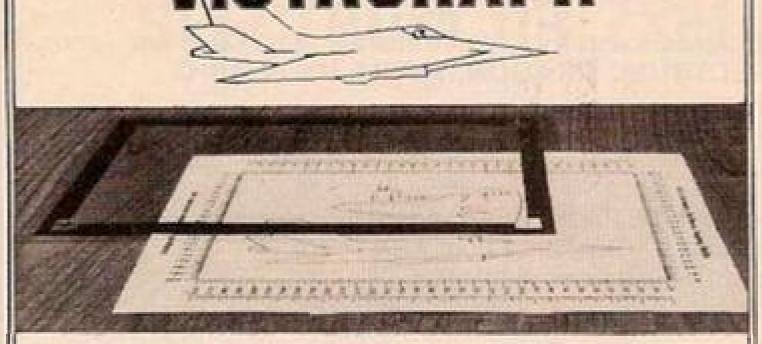
Special Packages from OZ SOFTWARE for the 16k & 48k SPECTRUM

Package 1. MADCHICKEN
A machine code game that is as exciting as frogger. MADCHICKEN has automatic increasing levels of difficulty. Supergraphics. The MADCHICKEN must avoid the traffic, foxes and jump on and off rapidly moving logs to get home. You are warned that this game is not for the slow.
Package 2. PILLMAN & DESIGNER
PILLMAN:— Our version of a popular arcade game with nasty spiders to outwit you. Six levels of play.
DESIGNER:— This utility program allows you to design, save and use your own graphics on the Spectrum Keyboard.
Package 3. "FROGGY"
A machine code game suitable for all ages. Guide your frog across the busy road, but beware of fast moving cars.
Package 4. TRAINMATHS
A teaching program for all ages. With ADD SUBTRACT MULTIPLY and DIVIDE options. Uses helpful graphics to stimulate young children into getting the correct answers. Dare adults try it?
Package 5. HANDYMATHS
A collection of useful mathematical **solutions** to the following:— simultaneous equations, Quadratic equations including complex roots, Mean & S/D, Linear Regression, Mortgage Repayments with easy alterations to the variables.
Package 7. SPECSOUND
This program allows you to create and save machine code level sounds. The package also has a library of 20 sounds for you to listen to and use. The m/c sound routines you have created can easily be added to your own games. The program has many other features and is interactive throughout.
Package 7. DESIGNER
A special offer on the DESIGNER program in 2 above — for only £2.95.
ALL PROGRAMS FIT THE 16K & 48K SPECTRUM. PACKAGES 1 to 6 ARE ONLY £4.95 each.
SPECIAL OFFER A self adhesive label that can be attached to the Spectrum. It contains references to useful PEEKS & POKES. Saves time looking through the manual. £1.55 each.

Cheques/P.O. crossed and payable to: **OZ SOFTWARE, 6 RODMELL RD, AINTREE, LIVERPOOL L9 9AH.**

Please send me ☐1 ☐2 ☐3 ☐4 ☐5 ☐6 ☐7 ☐Label *Please tick box.*
NAME ____________
ADDRESS ____________
____
POSTCODE ____________
I enclose a cheque/P.O. for £ ____________ YC 3/83

VICTAGRAPH



PLOT WINDOW

Now supplied with offset calibrated window especially designed for

ZX SPECTRUM

place your drawing etc. in the Victagraph and you are ready to plot and draw, using the movable window mask and offset co-ordinate window.
With easy to ead scale and EASY FINDER to help with negative and zero numbers. Combine PLOT, DRAW and CIRCLE to advantage with Victagraph-Plot Window.

UK only
Total price ZX Sectrum £7.50 — Atari 4/800, Dragon 32 £7.00
Please state WHICH — Cheque/P.O. to Victa Ceramics. Tel: 08894 2426

VICTA CERAMICS (YC)
6A BOW STREET, RUGELEY, STAFFS. WS15 2BT.

Extend your ZX81 System: Add Memory that won't Forget!

- ADD YOUR OWN SYSTEM UTILITIES
- BUILD UP A LIBRARY OF MACHINE LANGUAGE SUBROUTINES
- UP TO 8K NONVOLATILE RAM
- USE HM6116P CMOS RAM OR 2716/2732 EPROM
- COMPATIBLE WITH 16K RAM PACKS



INTRODUCTION

This memory board is designed to fill the transparent 8K block of memory (from 8 to 16K) in a ZX81-16K system. This area of memory is an ideal place to store, either permanently or temporarily, machine language routines or data which are to be used by the BASIC system. Such routines could be, for example

- fast graphics routines
- custom mathematical or statistical functions
- Sinclair code/ASCII conversion tables
- octal/decimal/hex conversion routines
- interrupt servicing routines
- I/O servicing routines for control applications
- a disc operating (DOS) or other development system
- speech synthesis routines
- additional BASIC commands
- EPROM programming and verify routines

A sample rapid display routine and procedures for storing utilities on tape are included with the kit.

The use of HM6116P 2K CMOS RAM memory IC's with their own reserve power supply means that routines stored in the RAM are *nonvolatile* — the RAM retains its memory even when the ZX81 is switched off or reset. Moreover, being RAM, the routines you store in the memory are easily modified. The lithium cell supplied with the board will maintain sufficient reserve power for about ten months for 2K or for about two months for a fully populated board. A connector is made available for an alternative external supply.

With this board it's no longer necessary to place your machine language routines in REM statements, in string variables, or beyond RAMTOP. You can build up a resident library of machine utilities for use by your BASIC system.

Once your system utilities and other machine language routines are established you can, if you wish, replace the 6116P CMOS RAM's with 2716 or 2732 EPROM's.

OTHER OPTIONS

The board can be jumper programmed to occupy any one of the four 8K blocks of memory in the first 32K. You can, for example, modify the SINCLAIR operating system. Alternatively the board can be used as system/user RAM.

ASSEMBLY

Complete step-by-step instructions in a 16 page manual make assembly of the board easy. Construction takes between one and two hours. The kit (pictured above) is complete with a silkscreened solder-masked printed circuit board, all capacitors, resistors, transistors, sockets, connectors, integrated circuits, and the lithium cell. The board is supplied with one 2K CMOS 6116P-3 RAM — it will accomodate three more for a total of 8K.

HUNTER ELECTRONICS,
KENWAY, RAYMONDS HILL, AXMINSTER, DEVON

Send check or money order for £19.95 plus £1.95 shipping and handling to the address below. The printed circuit board with the instruction manual is available separately for £10.00 post paid.

HUNTER ELECTRONICS, P.O. BOX 5, AXMINSTER, DEVON EX13 5AS

Q.E.D. SYSTEMS

the producers of high quality software for your **SPECTRUM, DRAGON, APPLE II** and **ORIC.**

THE VARIETY PACE 25 specially selected programs to realise the potential of your new micro.
Spectrum, Dragon, Apple II, ORIC £4.95
(less than 20p per program!)

THE VIDEO CHALLENGE These are not just any games by Q.E.D. quality action packed programs.
Spectrum — Photon, Apes & Ladders, Microthello and Phantoms .... only £5.95
Dragon — Photon, Link-four, Microthello and Phantoms .... only £5.95
Apple II — Grand National, Star Trek, Link-four, Microthello .... cassette £5.95, disc £7.95

MACHINE CODE ASSEMBLER and UTILITIES Realise the full potential of your micro by writing your own machine code routines.
Spectrum, Dragon £6.95
(includes full documentation)

COMPLETE HOME MANAGEMENT Plan all your financial affairs with this Q.E.D. quality system.
Features include budget creation, maintenance and balance of all accounts (inc. credit cards). Full monitoring of expenses against budget and complete expenses reporting. This system is supplied with full documentation and operating instructions.
Spectrum, Dragon £9.95
Apple II .... (disc) £12.95

Calling all designers! Q.E.D. pay generous royalities for high quality programs and routines. All enquiries are treated in the strictest confidence. Why not send your programs today (details are available on request, please include s.a.e.).

All programs are supplied on quality cassettes, unless otherwise stated.

OFFER!
buy 2 get £1 off
buy 3 get £2 off
buy 4 get £3 off

Please send me on cassette/disc

THE VARIETY PACK .... THE VIDEO CHALLENGE

MACHINE ASSEMBLER & UTILITY .... COMPLETE HOME MANAGEMENT .....

for my .... MICRO with .... memory

I enclose my cheque/postal order for £ ....
(payable to Q.E.D. Systems).

Name ....

Address ....

....

Q.E.D. SYSTEMS
2 Sefton Gdns, Ashton Green, Ormskirk, Lancs., L39 6RZ.

YOUR QUICK-LEARN WAY TO BASIC OR COBOL

IN YOUR OWN HOME, IN YOUR OWN TIME, AT YOUR OWN PACE.

Learn computer programming quickly and easily through the renowned ICS "Open College" system, taking the course at your own pace and in your own time.

Use the famous ICS study texts, backed up by your own expert tutor, and learn computer programming, the proven way, with ICS home study.

Courses:
Introduction to Computer Programming
Programming in BASIC
Programming in COBOL



Approved by CACC   Member of ABCC

ALL DETAILS FREE—SIMPLY RETURN THE COUPON BELOW

Please send me your prospectus on Computer Programming

ICS School of Computer Programming

Name ....
Address ....

Div. National Education Corporation

Post to: Dept. **EE349**
ICS School of Computer Programming
160 Stewarts Road,
London SW8 4UJ

01 622 9911 (all hours)

JUPITER ACE

Forth programs for the Ace:

Tape 1: PEEKER (disassemble ROM and RAM in Decimal, Hex, ASCII Character & Binary) (32K) £4.50

Tape 2: SKETCH (user-definable screen cursor, with tape save), EDITOR (for text, with tape save), DEMO (of Sketch), NIGHT RIDER (simple game) (3K) £5.50

Tape 3: 3 FAST 3K GAMES (in m/c): Appleater, Parachute, Meteor Cruise (3K) £5.50

Tape 4: 4 CHALLENGING 3K GAMES: Saucer, Driver, Maze Para (3K) £5.50

Tape 5: FROGGER (needs 16K) £5.50

Tape 6: TOOLKIT (m/c routines inc. scroll up/down/left/right with/without wrap, invert, fill screen, etc) (16K) £7.50

Tape 7: CHARACTER DESIGNER (design your own characters) (16K) £6.50

ADAPTOR FOR USING ZX81 ADD-ONS (kit) (club members only) £7.50

ACE USER: magazine, £1.25/issue. Free to club members.

NATIONAL JUPITER ACE USERS CLUB: £7pa.

All prices inc p&p; Club members deduct £1 per tape. Cheques payable 'Remsoft' please. Allow 21 days delivery



REMSOFT
18 George Street
Brighton BN2 1RH
tel: 0273-602354

DRAGON 32
NEW FROM
TROJAN
"SPACE TREK"

Space Trek is an absorbing space wars game in real time which can be played in any of four levels. Special features include: Onboard battle computer. Long range galaxy scanning. A galaxy containing 100 quadrants. Impulse and warp drive speeds. Shield control and status reports.
THIS GAME IS A MUST FOR DRAGON USERS. APPROVED BY DRAGON DATA LIMITED.

THE TROJAN LIGHT PEN

Plugs into Joystick Port
Supplied with cassette of instructions
A simple to use device for micro fans

Send to: **TROJAN PRODUCTS**
Dept. PCK
166 DERLWYN, DUNVANT
SWANSEA, WEST GLAM SA2 7PF

Please send:
Space Trek — I enclose cheque/P.O. for £7.50.
Light Pen — I enclose cheque/P.O. for £10.00.
Both prices include post & packing.

MR/MRS..

ADDRESS..

....

TRADITIONAL GAMES FOR YOUR SPECTRUM OR ZX81

Quiet! Sociable! Easy to play!



ROULETTE (Spectrum 48K) £4.95
The best version of the Monte Carlo game available.
Full colour betting table on continuous display.
Most betting combinations accepted.
Up to 4 named players.
Automatic debit & credit of displayed bank accounts.

GAMBLING TAPE (Spectrum 16K) £2.95
Fruit Machine — holds — nudges — gambling feature.
Poker Dice and Slippery Sam.

CHILDRENS COMPENDIUM (Spectrum 16K) £4.95
(ZX 81 16) £2.95
Ludo, Snakes & Ladders, Beetle — Up to 4 named players. Noughts & Crosses and Fox & Geese, where you can play your friends or the computer.

Roulette & Gambling Tape £6.95
All 3 Spectrum programs £9.95
All prices include p&p. Money back guarantee.

DYMOND SOFTWARE
DEPT YC, HOSPITAL ROAD,
ANNAN, DG12 5HP, DUMFRIESSHIRE

BBC MODEL B
(or Model A with 32K)

CARCHASE £7
A superb new car chase game.
TOTALLY ADDICTIVE.
This game features rolling track Colour and sound effects.

ESP £3
Test your ability to predict future events with this program. With colour and sound.

ELIZA £3
Have a conversation with your computer Psychiatrist.

SPECIAL OFFER ALL THREE £10

Mail order only please to:

Ross Software
Dept YC1,
44 Premier Avenue,
Grays, Essex RM16 2SD.

THE NEW AND UNIQUE C.A.D. PROGRAMME FOR THE BBC (32K)
AT A VERY AFFORDABLE PRICE

Ideal for teachers, designers, artists, technical drawing and numerous other applications including your own form and stationery design etc.
This programme must be seen to be appreciated — your imagination is the only factor to limit its individual applications.

- Modes 0,1,2,4,5 (can be changed when programme is running).
- Multiple display of arrays enables infinite complexity.
- **FUNCTIONS:** Line, rectangle, triangle, circle, text (upper and lower case) and colour pallet (8 colours and flashing).
- **DRAWING AIDS:** Alignment grid, circle copy, delete, free memory, purge memory, variable cursor speed, clear screen and redraw.
- Shapes can be filled or outlined (no need for Fill Routines).
- Save and load to tape in about *20 seconds.*
- SPECIAL FACILITY — Rubber band mode — A very flexible and variable line drawing facility — must be seen.
- Free "redraw" routine to enable the pictures created to be displayed in your own programmes.
- Grafkey and Grafstik. Versions availble for keyboard — Grefkey and *ANY* type of joystick — Grafstik.

Fantastic Value only £7.95 inc. p&p
DISK £10.95

CLARES
222 Townfield Road,
Winsford, Cheshire CW7 4AX
Tel: 06065 51374

BBC I.J.K.'s RANGE OF QUALITY SOFTWARE CONTINUES TO EXPAND... BBC

MODEL A/B
Cassette 1: Star Trek/Candy Floss (very popular) **£6.50**
Cassette 2: Family Games (hours of fun) **£4.50**
Cassette 3: Mutant Invaders/Breakout **£6.50**
Cassette 8: Model A Invaders (M/C) **£5.50**

MODEL B (or A+32K)
Cassette 4: Beeb-Beep (Super Simon Game) **£4.50**
Cassette 5: Beebmunch (full colour Munchman) **£6.50**
Cassette 6: Super Hangman (animated, educational) **£4.50**
Cassette 7: 3D Maze (fast and intricate) **£4.50**
Cassette 12: Flags (Countries and Capitals) **£4.50**

CASSETTE 9
Contains model B Invaders. A superb feature adaptation of the arcade 'Space Invaders' game in machine code and hi-resolution colour graphics for the BBC Micro model B (or A+32K). Play normal game or choose from the many options including Missile, Bomb and Invader speeds. Invisible Visible and Shields no Shields. Quite simply the best.
Only £7.50 for MODEL B (or A+32K)

ALL OUR SOFTWARE IS AVAILABLE BEFORE WE ADVERTISE

CASSETTE 10
WORDPRO. Cassette based word processor for either Epson or Seikosha printers. Features right hand justification, alter, insert, delete, pages to tape, printer mode changes from within text line etc., etc. Complete with manual.
Only £10.50 inc. for MODEL B (or A+32K)

CASSETTE 11
ATLANTIS. The superb fast action arcade game written in machine code to illustrate to the full the machines fantastic colour graphics and capabilities. This game includes all the usual ATLANTIS/ SCRAMBLE features. Guide your submarine Nautilus along the undersea landscape and through the caverns avoiding mines, depth charges, rockets, jelly fish, serpants etc.
Only £7.50 inc. For MODEL B (or A+32K)

CASSETTE 13 – HYPERDRIVE
A new, very addictive machine code arcade game. Guide your laser tanks around the network of passages destroying the drone Aliens – but beware, evil OTTO lies in wait!
Only £6.50 inc. For MODEL B (or A+32K)

CASSETTE 14 – STRATOBOMBER
Another new highly colourful machine code arcade game. Can you keep the enemy fleet at bay long enought to destroy the nuclear reactor of the rogue Star Ship before it destroys your home planet? Superb graphics.
Only £7.50 For MODEL B (or A+32K)

NEW CASSETTE 15 – LEAP FROG
The fabulous 'frogger' arcade game reaches the BBC micro. Superbly written full colour machine code version for the Model B (or A+32K). Help the frog cross the road avoiding the vehicles travelling at different speeds, and cross the multi current river to reach the safety of the lilly pads. The game gets progressively harder – perfect for arcade addicts.
Only £7.50 for MODEL B (or A+32K)



WE'RE EXPANDING TOO... NOTE OUR NEW OFFICE ADDRESS AND CUSTOMER SERVICES

NEW ORIC MICRO software ready soon. Write or 'phone for availability.

- All Programs will run on all operating systems
- All software in stock before we advertise
- Send SAE for Brochure

IJK Software Limited
9 King Street,
Blackpool, Lancashire
(0253) 21555

24 HOUR ANSAFONE

48 hour despatch

ALL PRICES FULLY INCLUSIVE OF VAT AND P&P – NO MORE TO PAY!

BARCLAYCARD VISA

BBC MICRO GAMES

GEMINI PERFORMANC

It can do a powerful job for you

SPECIAL LIMITED OFFER

Buy just any two programs at £19.95 and take one at £19.95 FREE!

CASH BOOKS ACCOUNTS PROGRAM FOR BBC MICRO . . .£95.00

New

One of the most innovative business programs on the market. Most serious accountancy packages are written and coded by professional and competent programmers. The Gemini Cashbook Accounting program was written by practising Chartered Accountants and coded by professional and competent programmers. This is a fundamental difference.

This practical program is simple to use and will replace your manual cash and bank records and by giving you instant management information, it may even put your accountant out of job!

With exceptionally exhaustive user documentation, full technical back up and product update policy this program will increase the efficiency and profitability of your business. Take a look at the information this program will provide.

* summary of VAT information to enable you to complete your VAT returns
* cumulative receipts and payments report analysed over the standard profit and loss and balance sheet heading.
* option for departmental analysis of sales and purchases
* print out of all transactions
* journal routine for entering transfers between accounts and year end adjustment for debtors, creditors etc.
* year end trial balance
* profit and loss account and balance sheet.

These statements can be produced at what ever interval you require e.g. monthly, quarterly or annually.

Coming soon:– Integrated Sales + Purchase Ledgers

"... the systems worked immaculately when tested ..."
"Mailist is a very professional piece of software ..."
(Which Micro & Software Review Feb 83)

Here's a range of software for the independent businessman that's designed to harness the power of your micro to deliver the vital information you need in all key areas of your business. A breakthrough on both price and performance, each program is fully tested and comes with all the documentation back up you need.

"Gemini's range of software is in the vanguard of the releases for 'serious' micro users . . ."
(Which Micro and Software Review)

SPREADSHEET ANALYSIS
BEEBCALC £19.95
DRAGONCALC £19.95

New

FOR BBC AND DRAGON 32. Spreadsheet processors have proved to be important tools for using micros in business, scientific and domestic financial applications.

Without any programming knowledge at all, you may:–

* Set up a computerised spreadsheet, with chosen row and column names.
* Specify formulae relating any row or column to any other.
* Enter your source data and have the results calculated.
* Save the results on tape (or disk – BBC) for later reloading and manipulation.
* Print the tabulated results in an elegant report format.
* Experienced users may access saved files and write their own reporting or graphics presentation programs for the results.

Some typical applications:–

* Small business accounting applications, e.g. profit and loss statements and cashflow projections, break-even analyses etc.
* Investment project appraisal – anything from double glazing to oil rigs!
* Comparing rent/lease/buy options
* Processing the results of scientific experiments or field studies
* Engineering calculation models
* In fact, anything that involves repeated re-calculation of results presented in tabular or spreadsheet format.

Program Availability Chart:–

	Database	Stock Control	Mailist	Invoices & Statements	Spread sheet Analysis	Cashbook Accounting	Word processor	Home Accounts	Commercial Accounts
Sinclair Spectrum 16K or 48K	●	●	●					●	●
Dragon 32K or 64K	●				●			●	
VIC20 (16K+)	●	●	●	●				●	●
Sinclair ZX81 (16K+)	●								
Grundy Newbrain	●								
Texas TI99 4A	●								
Osborne 1	●								
Sharp MZ80A	●	●	●	●				●	●
Sharp MZ80K	●	●	●	●				●	●
Sharp MZ80B	●	●	●	●				●	●
BBC micro model A or B 32K	●	●	●	●	●	●	●	●	●

I'S NEW

E SOFTWARE

ur business at petty cash prices.

INVOICES AND STATEMENTS . . . £19.95

Compatible with most micros. See table. Ideal for the small business. A complete suite of programs together with generated customer file for producing crisp and efficient business invoices and monthly statements on your line printer. All calculations include VAT automatically, and the program allows your own messages on the form produced. This program gives you superb presentation and saves time on one of the most tedious tasks in the office.

COMMERCIAL ACCOUNTS . . . £19.95

Compatible with most micros. See table. A gem of a program, all for cassette, with the following features:– Daily Journal. Credit Sales. Cash Sales. Credit Purchases. Purchases – other. Sales Ledger. Purchase Ledger. Bank Account. Year to date summary. A fully interactive program suitable for all businesses. Files can be saved and loaded and totals from one file carried forward to another on cassette. Particularly useful from a cash flow point of view, with an immediate accessibility to totals for debtors and creditors. Bank totally supported with entries for cheque numbers, credits and, of course, running balance.

MAILING LIST . . . £19.95

Compatible with most micros. See table. A superb dedicated database to allow for manipulations of names and addresses and other data. Gemini's unique 'searchkey' system gives you a further ten 'user-defined parameters' to make your own selections. Features include the facility to find a name or detail when only part of the detail is known, it will print labels in a variety of user specified formats.

DATABASE . . . £19.95

Compatible with most micros. See table. The program that everyone needs, the most valuable and versatile in your collection. Facilities include sort search, list print if required. Can be used in place of any card index application; once purchased you can write your own dedicated database to suit your particular needs with a limitless number of entries on separate cassettes.

STOCK CONTROL . . . £19.95

Compatible with most micros. See table. Dedicated software with all that's necessary to keep control of stock. This program will take the tedium out of stock control and save time and money. Routines include stock set up, user reference number, minimum stock level, financial summary, line print records, quick stock summary, add stock, delete/change record and more.

HOME ACCOUNTS . . . £19.95

Compatible with most micros. See table. Runs a complete home finance package for you with every facility necessary for keeping a track of regular and other expenses, bank account mortgage, H.P. etc. This program also allows you to plot graphically by Listograms your monthly outgoings.

WORD PROCESSOR . . . £19.95

Compatible with most micros. See table. This program features routines found in much larger and more expensive packages with a typical word length of 5-6 letters it allows for around 1000 words in memory at one time. Ideal for the user who requires a simple program to write letters on his computer. Features include, block delete, block insert, search and replace, edit text, display text and more.

Dealer/Trade enquiries invited – generous trade discounts for quantity

Special ACCESS card instant sales hotline for GUARANTEED despatch within 24 hours . . . Tel: 03952-5165

24 hr Ansaphone Service.

All enquiries other than credit card sales to 03952-5832

Gemini. Functional Software Specialists. 9, Salterton Road, Exmouth, Devon.

Tick the box for Program you require. Prices include V.A.T. and Package and Postage.
Please supply the following cassette software.

Database	£19.95 ☐	ZX81 16K Database	£9.95 ☐
Stock Control	£19.95 ☐	BBC Cash Book disk or tape	£95.00 ☐
Mailing List	£19.95 ☐	BBC Disks – other titles	£23.95 ☐
Invoices and Statements	£19.95 ☐	Osborne Disk Database	£23.95 ☐
Commercial Accounts	£19.95 ☐	Word processor	£19.95 ☐
Home Accounts	£19.95 ☐	Beebcalc	£19.95 ☐
		Dragoncalc	£19.95 ☐

Name________________________________

Address______________________________

Machine Type______________ Memory Size______________

I enclose______________________________

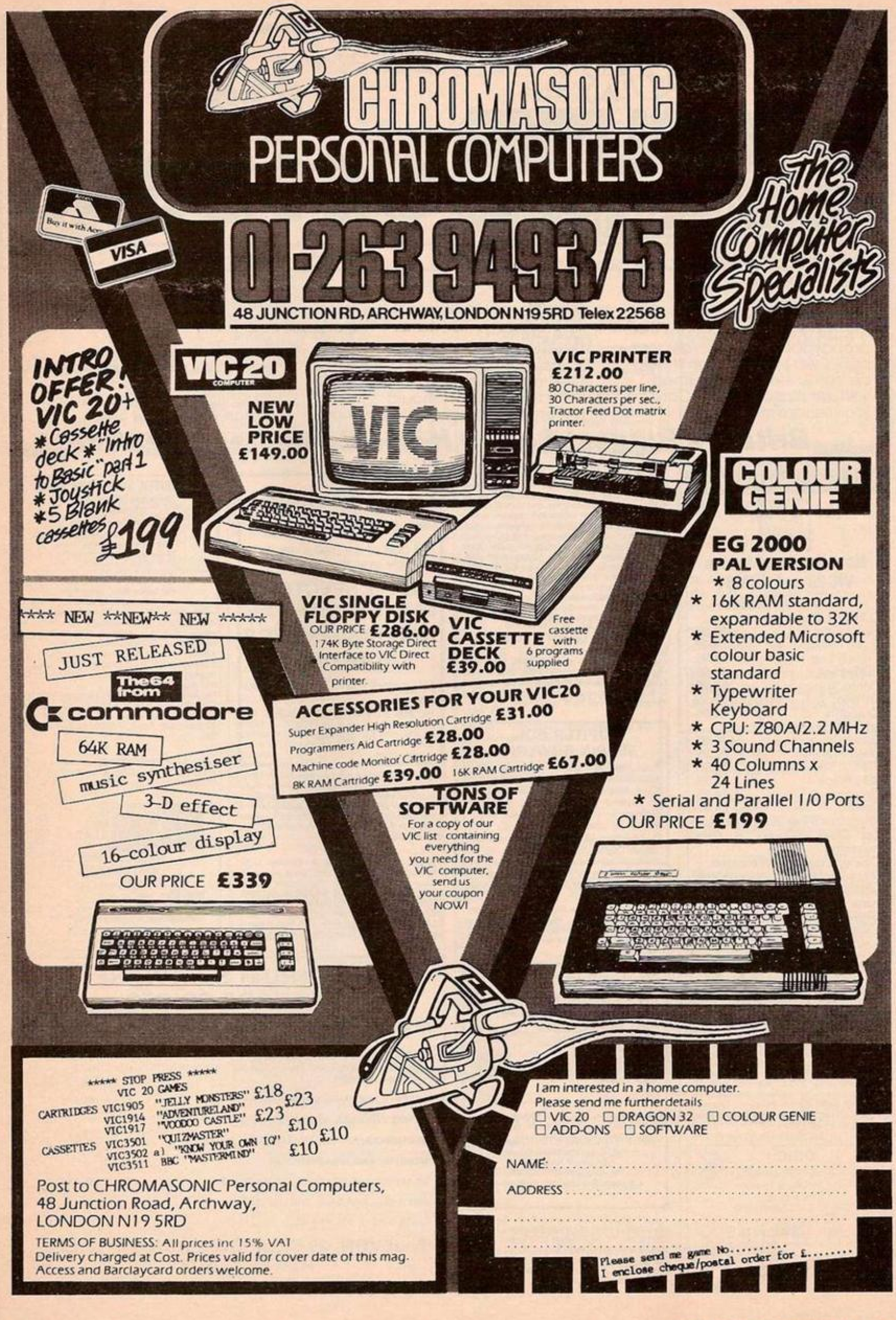
Make cheques and postal orders payable to Gemini Marketing Ltd.

Diners Card Number______________ Access Number______________

Signature______________

Gemini. Functional Software Specialists, 9 Salterton Road, Exmouth, Devon.





CHROMASONIC
PERSONAL COMPUTERS
The Home Computer Specialists
VISA
01-263 9493/5
48 JUNCTION RD, ARCHWAY, LONDON N19 5RD Telex 22568
INTRO OFFER! VIC 20+ * Cassette deck * "Intro to Basic" part 1 * Joystick * 5 Blank cassettes £199
VIC 20 COMPUTER
NEW LOW PRICE £149.00
VIC
VIC PRINTER £212.00
80 Characters per line, 30 Characters per sec., Tractor Feed Dot matrix printer.
COLOUR GENIE
EG 2000
PAL VERSION
* 8 colours
* 16K RAM standard, expandable to 32K
* Extended Microsoft colour basic standard
* Typewriter Keyboard
* CPU: Z80A/2.2 MHz
* 3 Sound Channels
* 40 Columns x 24 Lines
* Serial and Parallel I/O Ports
OUR PRICE £199
**** NEW **NEW** NEW *****
JUST RELEASED
The64 from
commodore
64K RAM
music synthesiser
3-D effect
16-colour display
OUR PRICE £339
VIC SINGLE FLOPPY DISK
OUR PRICE £286.00
174K Byte Storage Direct Interface to VIC Direct Compatibility with printer.
VIC CASSETTE DECK £39.00
Free cassette with 6 programs supplied
ACCESSORIES FOR YOUR VIC20
Super Expander High Resolution Cartridge £31.00
Programmers Aid Cartridge £28.00
Machine code Monitor Cartridge £28.00
8K RAM Cartridge £39.00 16K RAM Cartridge £67.00
TONS OF SOFTWARE
For a copy of our VIC list containing everything you need for the VIC computer, send us your coupon NOW!
***** STOP PRESS *****
VIC 20 GAMES
CARTRIDGES VIC1905 "JELLY MONSTERS" £18
VIC1914 "ADVENTURELAND" £23
VIC1917 "VOODOO CASTLE" £23
CASSETTES VIC3501 "QUIZMASTER" £10
VIC3502 a) "KNOW YOUR OWN IQ" £10
VIC3511 BBC "MASTERMIND" £10
Post to CHROMASONIC Personal Computers, 48 Junction Road, Archway, LONDON N19 5RD
TERMS OF BUSINESS: All prices inc 15% VAT
Delivery charged at Cost. Prices valid for cover date of this mag.
Access and Barclaycard orders welcome.
I am interested in a home computer.
Please send me furtherdetails
☐ VIC 20 ☐ DRAGON 32 ☐ COLOUR GENIE
☐ ADD-ONS ☐ SOFTWARE
NAME: ....
ADDRESS ....
Please send me game No..........
I enclose cheque/postal order for £........

YOUR COMPUTER CLASSIFIED

01-661 3036

ADVERTISEMENT RATES

Linage: 30p per word (Min. 15 words)
Box No: £3.00 extra
Linage advertisements are prepayable and the order form published in this section should be completed and returned with remittance. Credit Card facilities are available.

Display — rates per scc (Min. 2scc)

One insertion	:	£7.00
Three insertions	:	£6.70
Six insertions	:	£6.50
Twelve insertions	:	£6.00

Display advertisers should preferably reserve space by phone.

Copy Date

Closing date for Classified advertisements is the 10th of the month preceding publication date.
Post to
Your Computer, Classified Department, Room H211, Quadrant House, The Quadrant, Sutton, Surrey SM2 5AS.

Britain's Biggest Selling Home Computer Magazine

Viking Software

New Programs for the VIC-20 and CBM64 from VIKING

CBM 64 Cassettes

Stock Control	£14.95
Basic French	£5.95
French Test 1	£7.95
3D Escape	£5.95
Pontoon	£5.95
Othello	£4.95
Draughts	£4.95

VIC 20 Cassettes

Stock Control*	£10.95
Basic French*	£5.95
French Test 1*	£7.95
3D Escape	£5.95
Draughts	£4.95
Othello	£4.95

*Requires 8K or 16K Ram Pack
1st Class delivery & free postage.
Dealer Enquires Welcome.
Please make cheques/postal orders payable to: 'Viking Software', Unit 3, Meadow View, Browston Lane, Browston, Gt. Yarmouth, Norfolk NR31 9DP.

53/2

BBC software Model B or 32K Modela, Mutant Attack, Wild West, Earth Defence, Auto Dodge, Breakout. All five just £3.95 from A. Holmes, Fairway House, Ghyll Road, Crowborough Sussex.

7/2

No more eyestrain with your ZX81. Video inverter displays sharp white characters on solid black background TV screen. A toggle switch lets you choose between normal and reverse. The small PCB fits on top of the logic chip inside your ZX81. Kit £4, Built £5, includes easy to follow instructions, VAT/P&P. Send cheque/PO to: D. Fritsch, 6 Stanton Road, Thelwall, Warrington, Cheshire, WA4 2HS. Box No. 1

9/2

ORIC I
CASSETTE LEADS
Din to Din & remote jack plug
Din to 2 × 3.5mm jacks
1 × 2.5mm for remote
PRICE ONLY £2.50
Cash with orders includes p&p
CLARES
222 Townfields Rd, Winsford, Cheshire CW7 4AX. Tel: Winsford 51374.

58/2

VIC 20 best and latest Software super new club with unbeatable offers. Hire a cassette or cartridge then if you decide to purchase it simply send us the balance and we will refund your hire charge or return the cassette and if desired hire another. Note no obligation to buy whatsoever. Save pounds, join Comclub today! Plus a Super Bonus! All subscribers may purchase a genuine Commodore 16K Rampack for £49.95 or an 8K for £29.95. Also if you decline this offer, then accept a free Comsoft Draughts (UNEX) cassette RRP £6 or Comsoft Wordsearch (8-16K) cassette RRP £8. Send for membership form and free catalogue to Comclub, 24 Alton Road, Aylestone, Leicester.

42/2

Sky program for ZX81 and Spectrum Computers. Details of Night Sky for every night of the year — send £5 to Mr J.S. Coombes, 97 Hollyfast Road, Coventry, CV6 2AE or send for details of other Astronomical Programs. Money back guarantee.

59/2

JUPITER ACE TENPIN BOWLING

Fast, skillful game with superb sound and authentic scoring. Complete with free details of how to expand your ace using a ZX81 Rampack. (Program requires 8K). Send £5 cheque plus S.A.E. to: K. Longley, 13 Sandiway, Heywood Lancs OL10 4BY.

Acorn Atom 12K, F.P., Via, P.S.U. Plus £30 worth Software £150 ono. 904 9210 Evenings.

57/2

Acorn Atom "Space-Man" 2.5K Monsters, Power-Plus, Sound, Highscore, Auto-Run cassette £4.50, instructions. S. Brown, 1. Ailsa Lane, Itchen, Southampton.

51/2

DRAGON 32 SOFTWARE

Quality software at sensible prices.

Caterpiller + Space Attack	£2.95
Meteor Run + Breakout	£3.95
Haunted House	£3.95
A-Z Chase + Moneybags	£3.95
Forbidden City	£4.95
Devil's Island	£4.95
Golf	£4.95
Goblin Caves	£4.95

Prices include p&p. Send cheque/PO for first class return post service. S.a.e. list.
APEX TRADING LTD. (Dept. YD), 115, Crescent Drive South, Brighton BN2 6SB
Tel. Brighton (0273) 36894
Access/Barclaycard welcome

1/2

Pools Prediction Spectrum or ZX81. Score and probability rating. Random selector and perm calculator. 12 page leaflet and record sheets. Simple data entry from league tables cassette etc. £5. Integrated accounts for Spectrum 40K program S.A.E. for details. Willden Yew Tree Lane, Rotherfield East Sussex.

13/2

BUFFER MICRO SHOP
(Near Streatham S.R. Station)
The best of the mail order items available over the counter for
ZX81 & SPECTRUM
Open 10.30 to 5.30 Tues to Sats.
NEW BIGGER SHOP NOW OPEN
Tel. orders using access or visa welcome
210 Streatham High Rd.
London SW16
01-769 2887

Spectrum Programming. Learn Basic Programming the easy way with our fully structured cassette course. Let the computer teach you! 250K of programs ending with a computerised exam. Only £9.95, Barclaycard accepted. Sussex Software, Wallsend House, Pevensey Bay, Sussex.

55/2

VIDEO GAME T-SHIRTS Quality U.S. imported 50/50 poly/cotton shirts superb 5 colour prints based on the arcade games PACKMAN ASTEROIDS SPACE INVADERS TEMPEST MISSILE COMMAND FROGGER DONKEY KONG Chest sizes 24"-44" only £3.95 inc P&P. Cheque/P.O. to Neil How, 3 Victoria Road, Leamington Spa, Warks.

28/2

MONSTER SOFTWARE CLUB
Software library for the DRAGON 32
Top quality cassettes FOR HIRE
All tapes used with the Manufacturer's permission
SAE for details
Monster Software Club
32 Lennox Drive, Lupset Park
Wakefield, West Yorks.

56/2

WORLD INFO, a database of information about the modern world. Readers of newspapers, students and teachers of Current Affairs International Relations and Modern Studies need it. Includes wars, areas of tension, top men, types of regime, alliances and much more.
For ZX81. Full file on 32K; parts on 16K. Uses Campbell Systems THE FAST ONE. Spectrum version in preparation. £14 from WIMSOFT, 20 Brookside Road, Wimborne, Dorset BH21 2BL.

19/2

Acorn Atom 12K + 6522. Ross Software ROM Joysticks 25 Programs 5 Books £230. 0945 780324.

45/2

TEXAS
TI 99/4A
CASSETTE LEADS
£7.95
INCLUDING POST AND PACKING
Single Recorder only
Orders to:
Clares, 222 Townfields Road, Winsford, Cheshire CW7 4AX
Tel: Winsford 51374

58/2

SPECTRUM SOFTWARE AT TRADE PRICES

FLIGHT SIMULATOR. PILOT YOUR OWN PLANE — VERY REALISTIC COCKPIT	16K-48K	£2
HORSE RACING PREDICTOR. FEED IN YOUR DATA FROM DAILY NEWS-PAPER. BY USING THE PREDICTOR AND YOUR INTUITION YOU COULD BE ON A WINNER!	16K-48K	£2
CREEPY-LAND. ADVENTURER BEWARE!	16K-48K	£2
GAMES BONANZA. MAZES, INVADERS ETC.	16K-48K	£2
ASSEMBLER. FOR YOU MACHINE CODE BUFFS	16K-48K	£2
MONITOR AND DISASSEMBLER		£2
GRAPHICS AID. GRAPHICS ALL MADE EASY	16K-48K	£2

ANY 3 £5 — BARGAIN, THE LOT £9.50

CHEQUE/PO + 50p, P&P TO

T. JEVON, 29 CROP COMMON, HATFIELD HERTS AL10 0DG

64/2

BUTTERCRAFT SOFTWARE

14 Western Avenue Riddlesden, Keighley, Yorks. ENGLAND

our BEST-SELLING **ATUO-SONICS** is now available for
ZX SPECTRUM and *TRS-80/VIDEO GENIE.*

LET BUTTERCRAFT PUT EXCITING *SOUND-EFFECTS* INTO YOUR PROGRAMMES!

● *YOU* design the sounds using your *EARS* and the 8-function on-screen control panel.
**AUTO-SONICS* turns your sound-designs into *programme lines* that will reproduce them exactly — time after time!
**26 BUILT-IN EFFECTS* Space sounds . . animals . . engines . . etc. . . etc. . . use them just as they come or just twist & bend & shape them into thousands of new effects.
**EVERY SOUND YOU HEAR* can be inserted into *your* programmes to bring them instantly alive — it's magic! Cassette/Instructions £4.99 (state machine).

PROVIDE INTERNAL AND EXTERNAL SOUND ON VIDEO GENIE.

AMPLIFY YOUR COMPUTER FOR ONLY £4.99 + 50p. p.p.)



UNISONIC AMPLIFIER/AM RADIO. * Use cassette lead to connect to your computer for instant loud, clear amplification of all sound output.
*UNPLUG and it's a neat pocket radio with smart wrist-strap. Needs one PP3 battery. (not supplied).

SUPER ARCADE-SYTEL GAMES FOR ZX SPECTRUM.

GULPMAN
Superb version of shh . . . you know what! 15 mazes, 9 speeds, 9 grades, hi-res colour/sound . . fast m/c, hi-score, etc. "An extraordinarily good program — well worth the price." *P.C.W. magazine.* **£5.95**

WINGED AVENGERS
7 speeds . . laser shield . . mothership re-fuelling . . smart bombs . . hi-socre . . all m/c . . colour + sound. "One of the best Sinclair games yet." *Y.C. magazine.* **ONLY £4.50**

SCRAMBLE Condition Red
Hi-res. colour-graphics . . missiles . . bombs . . fuel dumps . . meteors . . 8-direction control . . hi-score . . all m/c. SUPER ARCADE ACTION FOR ONLY **£4.95** 70/1

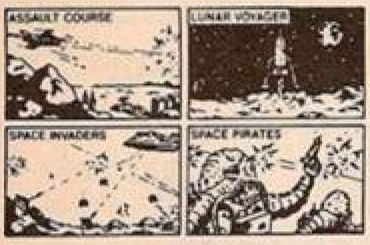
Load Level Meter with save/load switch for the ZX81 or Spectrum. £6.95. Bookham 54954.
40/2

BBC:/MX80FTIII Screen Dump Utility. Extra large printout on two sheets or print screen full width but down instead of acrosr sheet. £7. Also MZ80K Armoured Invasion. Gripping game, nine skill levels. Sound, good graphics. £7. Slavedrive Software, 19 Newlay Lane, Bramley, Leeds 13 LS13 2AL. 6/1

Spectrum software. 'Pools Forecast Aid': Results analysis since 1952 evaluated trends for drawn matches. Direct input and print-out. 16 or 48K. biorhythm: Scientific 'life-cycles' principles provide prediction of physical, emotional and intellectual intensity levels. 16K £4.95 (16K), £5.95 (48K), to J English, 10 Meadow Close, Shipdham, Thetford IP25 7NF.
15/2

Informatics student is looking to buy ZX-Spectrum Issue 2. Please contact Mike Lucker, Lothringer Str. 103, D-5100, Aachen. I'm further interested in program exchange with British students.
37/2

TRS80 — VIDEO GENIE SOFTWARE



We offer a great selection of games and utilities from many leading software houses at reduced prices. As a special offer, to introduce you to our software, we are giving away, well almost, a software pack with a super variety of 25 full length programmes on it, and all for only £7.50!!! Do not miss out! Send for your illustrated catalogue today. Please enclose an s.a.e.

SPARTAN SOFTWARE
DEPARTMENT YC
9 Cotswold Terrace,
Chipping Norton, Oxon.
Telepone:— 0608-3059.
31/1

DRAGON-32 SOFTWARE. Business software from £9.95. Educational & games from £2.95 S.A.E. appreciated. MISTRY MAGIC (yc), 75 St. Margaret's Road, Bradford BD7 2BY.
60/1

VIC20 tape of six games. Minefield, Bats/Bugs, Bricks, Ski-run, Brands, Jelly-Men. Available from D. Poynter 6 Borrowdale Close Wistastow Crewe £5.50. 69/1

Vic 20 (3.5K) "Bomber" Hi-Res Adaptation of "Blitz" only £1.99. Databrain Software "Greystoke" Park Road, Bowdon, Altrincham, Cheshire, WA14 3JG: on cassette.
8/2

Atom Adventure investigate strange happenings in the Old Manor — then try to escape. 12K M/C £6.00 from Fourth Dimension Software, 15 Killearn Drive, Paisley PA1 3DG.
43/2

VIC-20 (unexpanded) Games Tape: Punkman, Black Knight, Grand Prix, Cavern Shoot, Amaze, Side Shoot. All 6 for £5 inc. P&P. Fast delivery, from: Starraker, 21 Hoyle Road, Hoylake, Wirral, L47 3AG.
49/2

SALE — SALE

DRAGON 32 GAMES

STARTREK III (superb graphics) £8.00
CHECKERS (children's delight) £3.50
3-D DESIGNER (shapes galore) £5.00
LUNA LANDER (a challenge) £4.00
DRAGONSLAYER (the ultimate adventure) £10.00

S.A.E. & 50p for Catalogue
SAINT GEORGE SOFTWARE, Dept. YC,
73 Ling Street, Liverpool L7
29/1

USER-DEFINED GRAPHICS FOR THE 12K ATOM + FULL LOWER-CASE. Design your own model characters and move them around with m/c speed also screen-editor, keybeep, renumber, flashing cursor, auto-repeat, extended-line, £4.95.
SPACE-ADVENTURE (22K) New fast moving m/c & Basic program (Atom), Spacecraft simulators, stunning hi-res graphics £6.95.
ZX-SPECTRUM (16K) FRUITMAN all the arcade features ghosts, dots, fruit, special dots, tunnel and hi-score (full colour + exciting sound) £4.95 cheques to J. Quinn 26 Forsyth St. Scotland (PA16 8DT).
30/2

WORTHWHILE PROGRAMS

16K ZX-81 and 48K Spectrum.

FIRST AID — teaches the principles of first aid. Fully scoring. Ages 13+.

COMMUNICATOR — Morse code, semaphore, verbal reporting, use of telephone. Ideal for cubs and scouts. £4.99 each. State machine. Cheques/POs to:

Network Computer Systems Ltd.
39 Bampton Road, Luton, Beds.
9/1

Acorn Atom 12K + 12K, PSV, £60 + software worth £300. Can deliver ANYWHERE Bargain £140 061681 2875. 10/2

Swap your unwanted software via Software Exchange Club. S.A.E. for details, UKsec 15 Tunwell Greave Sheffield S5 9GB. 24/1

ZX-81 GRAPHICS board £19.95. Fits inside case. Define up to 64 characters (+ inverses). SAE, D. Hutchinson (Circuits), 103 Vicarage Wood, Harlow, Essex. 14/1

MZ80K/A Horserace Analysis, Winners galore. A serious program. Cassette: £5.75. Details: Paragon Moorside Woodlands Wimborne Dorset.
26/1

Spectrum Games Sale. Venture (7 games in 1), was £6. 3 compulsive games, was £5. The lot on one cassette for just £6, Bobker, 29 Chadderton Drive, Unsworth, Bury, Lancs.
61/1

Spectrum 16/48K Software Pack. Contains two space games, two tank games, mini-adventure, board game plus more on one cassette. £3 to Allan Morton, 16 Ben Ledi Road, Kirkcaldy, Fife.
44/2

BULLDOG SOFTWARE LIBRARY

offer programs for ZX81/Spectrum, Vic, BBC, Dragon, Oric. These include exciting arcade/adventure games and educational/business applications. 12 months membership is £10, hire charges £1.35 per two week period. You will receive an informative monthly newsletter, a continually updated catalogue and order forms. Full money back guarantee. Send now: **24 Southernhay East, Exeter, Devon.**

Dragon-32 Games for family entertainment. Munchers, Breakout, Hangman, Jackpot, Aeroplane, Lightcycle. All on one cassette. Price £6.50 including VAT and P&P. Send your cheque to Teesimage Ltd, Bridewell Lane, Tenterden, Kent TN30 6EY.
62/2

Acorn Atom 12K ROM 12K RAM P.S.U. Books Software £150. Tel: Sheering 384 during day.
39/2

BBC

Programs for the BBC Micros A & B: Dalek: Fast M/C "arcade" game. Hi-res graphics & sound. £6.
Tharon: Dynamic adventure game on an Alien World. £4.
SAE for free catalogue. Cheques to Tachyon Computing, 168 West Wycombe Road, High Wycombe, Bucks. HP12 3AE.
21/2

Spectrum Speaker you just plug speaker into the mic. Output. No soldering. Volume control cased £5.50. 11 Nettleton Close, Canford Heath, Poole, Dorset, BH17 7PL, Mr J. Hunter.
29/2

Spectrum Races 1-10 players, Bookmaker, stunning M.C. graphics. Pontoon, high-res picture cards. Missile destroy tanks, planes, before they destroy you. On cassette, £4 inclusive, Cheques to Redman, 43 Mere Knolls Road, Sunderland, SR6 9LG.
31/2

DRAGON 32 or TANDY TRS-80 Colour

Lots of programs — lots of useful hints and information EVERY single month in "RAINBOW" an exicting new 200-page magazine from U.S.A.

Send £1.95 (plus large 56p s.a.e.) for sample issue to

ELKAN ELECTRONICS (Dept. YC), FREEPOST, 11 Bury New Road, Prestwich, Manchester M25 6LZ or telepone 061-798 7613 (24 hour service).
4/2

BBC 32K Monopoly. Up to six players including computer. Computer considers deals and offers exchanges. Short and standard game options. Gamesave facility. I Skelly 31A Hillfield Drive, Heswall Merseyside. £6 inc P&P.
25/2

BBC quality programs: Low prices. "Chess Clock" (16K) — £1.95. "Two-player Blackjack" (32K) — £2.45. Datum, 22 Chesterfield Road, Southport, Merseyside.
11/2

Sharp MZ80K, 48K. Year's warranty. Four versions of Basic, machine code, chess, adventures, databases, arcade games £325 021-458 4582. (Birmingham).
22/2

Dragon screencopy programs for Seikosha GP100A — print both text and hi-resolution screens — in up to four shades — £5.95 for cassette plus full details — Brain Power Penygaer Groeswen Cardiff CF4 7UT.
24/2

CESIL. BBC model B. CESil as described in Computer Studies — Book 1. Tape plus instructions £8. V. Webb, 3 Poplars Grove, Maidenhead, Berks, SL6 8HD.
41/2

MZ-80A/K Wordpro £8, Databank £6, Copier £4, Games £3. List — SAE: DCS, 38 South Parade, Bramhall, Stockport.
52/2

Spectrum Disassembler & Blitz tapes £2.00 each or £3.50 together inc p&p. Send cheque/PO to Holliday, 44 Lennard Road London SE20 7LX. 40/1

SPECTRUM 32K RAM — £24.50

Upgrade your 16K Spectrum to 48K with our RAM kit. Only fits Issue 2 machines, identified by *a large chip in a socket in line* with the "9" key, visible through the rear expansion cutout. The kit consists of chips and instructions, and NO soldering is needed.
£24.50 incl. VAT and P&P

* * * * * * * *

HAPPY WITH YOUR DISPLAY?

Or have you got problems?

- Are your whites yellowish?
- Is every other line a different colour (like Venetian blinds)?
- Do your characters wobble? (Some character wobble is bound to exist, but it can be reduced)

We have prepared instructions to allow any Spectrum to give the best possible results, by adjusting internal controls.

Send £1 plus S.A.E. *(Sent free if you order the RAM.)*

Fountain Computers Ltd., Darvill Road, Ropley, ALRESFORD, SO24 0BE.
43/1

Vic-20 software Chess £7.00, Panic £7.00, Frogger £9.99, Skramble £9.99, plus many more. Write to: Live Wire 2 Hazel Crescent, Thornbury, Bristol (0454) 412835.
12/2

Store information. Storage program for any Spectrum options include: Insert, Delete, Alter, Recall, Save. Only £3.50 on cassette with full instructions. P Banning. Box No. 2.
26/2

TINY PASCAL PLUS for PET (16K +, all ROMS, disc or cassette) and APPLE (disc). Package consists of line editor, compiler, p-code interpreter, 50 page manual & sample programs. £29.95
VIGIL interactive games language for PET or VIC (6.5K +). Includes 9 games & 50/70 page manual. £19.95.
SAE for full software catalogue to:— ADAMSOFT (dept. YC), 18 Norwich Avenue, Rochdale, lancs. OL11 5JZ.
20/1

Software urgently required!!! Arcade games. Can you write programs for Vic 20, ZX81, ZXSpectrum? We pay top prices for good, exciting games. Put your genius to work with high rewards. Write to Northwish, Balli Building, Stanley Street, Manchester M35FD or phone 061 832914 today.
23/2

Weekend courses in Sinclair Basic, starting February 1983. 15 hours of instruction from a qualified lecturer, Friday evening to Sunday evening.
Luxurious 3-star Worcestershire Hotel, all rooms with bath and other facilities.
£55.00 inclusive.

GAINSBOROUGH HOUSE HOTEL
Bewdley Hill, Kidderminster
(0562) 754041
1/1

BBC (32K) and VIC 20 (6.5K)

DON'T JUST TALK ABOUT EDUCATIONAL SOFTWARE . . . TRY OURS! EVERY PROGRAM IS CLASSROOM-TESTED AND FULLY GUARANTEED.
"LETTERS" (BBC only) — for ages 4 to 6 — teaches the correct way to form lower-case letters of the alphabet. Great graphics. Give your child a head-start in learning to write. £9.95 for suite of 5 programs.
"SEQUENCES" Seven common mathematical sequences clearly demonstrated using full colour and sound (eg primes, squares, Fibonacci . . .) £5.95
"METRICS" Revises and tests understanding of volume, length, capacity, area, and mass. Five programs on one tape for £9.95.
. . . and many more. SAE for complete list to:

Chalksoft Lowmoor Cottage (YC3), Tonedale, Wellington, Somerset TA21 0AL. 082 347 7117
16/2

Spectrum 48K special introductory offer, free diary system with the Bank Account System, written to professional standards, full screen entry, maintains transaction file of Standing Orders, Salary, Cheques, etc., prints statements, why wait for the Bank, cassette and user manual, £5.00, Kim Gouldstone, 45 Burleigh Avenue, Wallington, Surrey, SM6 7JG.
32/2

MUSICSOFT
BBC MICRO 32K A/B.

5 music games of memory and dexterity. Multicolour graphics. Fun for 5 year olds yet frustrating for graduates. Variable speeds and scale levels. Cassette and Instructions £3.50

Cheques to Musicsoft
12 Fallowfield, Ampthill, Beds.

16K ZX81 Leads + manuals ASMIC chip for m/c programming, £60 worth of games + mags, tape recorder all for £120. Good Easter 322.
5/2

Vic 20 owners. Exciting educational programs. Suitable for children aged 6-12 years. £5.00 plus 50p P&P. Send for details E.C.P. 99 High Street, hail Weston, St. Neots, Cambs.
6/2

Printers for £14.95? Yes, only £14.95 for a New plain paper printer. Cheques/P.O. + £1.25 P&P to: — P. Ralpha, 1 Duxford Walk, Moston M/109JN.
34/2

ZX81/16K Games Cassette. Four Programs (One Armed Bandit, Word Game, Lunar Landing, Golf). All on one tape. £4.95 to Ushers, 60 Station Road, March, Cambs.
54/2

TEXAS TI99/4A SOFTWARE on tape, from £1.95. Send s.a.e. for list. Apex Trading Ltd. (YT), 115 Crescent Drive South, Brighton, BN2 6SB.
65/2

ZX81, 16K Tuition, testing, problems (randomised) on Pythagoras Theorm — for C.S.E./'O' mathematics. Previous knowledge unessential. Cassette £4.50. C. Jones, 4 The Eyrie, Burton-on-Trent DE15 0DT.
3/2

SPECTRUM

INTRODUCTORY OFFER: Large selection of software and add-ons at discount prices including:
Masterfile £14.25
The Hobbit £14.20
Pimania £9.50
Black Crystal £7.12
Time Gate/Football Manager/ Penetrator £6.60
Orbiter/Ground Attack/Gulpman/Nightflite £5.65
Escape/3D Tunnel/Mazeman £4.70
Over 75 different programs in stock!
P&P 50p Free on 3+tapes.
Send large S.A.E. for complete list.
IVYSOFT, Dept. YC, 91 Cleeve Drive, Ivybridge, Devon PL21 9BS. Tel: (07554) 4088
63/2

ZX81 and Spectrum educational and games software send SAE. B Horsfield 23 Lealholm Crescent Middlesrough.
27/2

Computer or Daisy Wheel Printer wanted urgently, anything considered. BSG, 24 Southernhay East Exeter 0626 862455.
33/2

VIC-20 Software Cassettes, £3.95 each inc. postage. No. 1: The Raider, Spacewarp, Breakout. No. 2: Skier, Cowboy shoot-out. No. 3: Scramble. All for the unexpanded VIC-20, uses Hi-Res colour graphics and sound. Cheques/P.O.s. to A. Carter, Ewelme, Ewen, Cirencester, Glos. GL7 6BU.
38/2

BAUG SOFTWARE

Introductory offer ATARI 7½% off hardware up to 20% off Software. Commodore and Drag on. 10% off X87 key-board £26.00.
Telephone 0232-621221 for details P.O. Box 123, Belfast BT10 0DB.

Spectrum software library. Weekly hire from 50p. Try programme out before you buy. Send stamp for free catalogue to Thomas McQueen. 25 Blenheim Gdns; Brixton Hill, London. S.W.2.
50/1

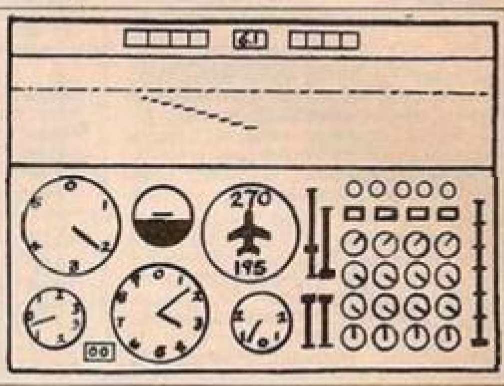
DRAGON 32

Five Exciting Games for ONLY £5.40

Hi-res colour and graphics
Fun for all the family
BULLS & COWS
MAZE RUNNER
HAMURABI
RATTRAP
EARTH DEFENCE
ARGENT SOFTWARE LTD
Dept YC
Midcourt House
25 Lynwood Chase, Bracknell, Berks RG12 2JT
46/2

DRAGON-32 AND BBC MODEL B
747 FLIGHT SIMULATOR

Superbly realistic instrumentation and pilots view in Hi-Res graphics. Lifelike simulation including emergencies such as engine fires and hydraulic failures. This 32K program uses the Dragon's excellent graphics facilities to the full to produce the most realistic instrument display yet seen on a home computer. There are 21 real dials and over 20 other indicators (see diagram). You control throttle, ailerons, elevators, elevator trim, flaps, slats, spoilers, landing gear, brakes, reverse thrust and see the runway centreline in true perspective. Uses joysticks and comes with bound 12 page manual. Includes options to start with take-off or random landing approach and restart. Cassette £9.95 (PP and VAT included).
D.A.C.C. LTD., 23 Waverley Rd., Hindley, Gtr. Manchester WN2 3BN.



DRAGON 32 AND SHARP MZ80K SOFTWARE

Games Packs — £6.50 each.
Games Pack 1 — Bowling, UFO, Muncher, Micropoly, Mastermind.
Games Pack 2 — Race-chase, Depth Charge, Motor Cross, Glorious 12th, Canyon Bomber.
Games Pack 3 — Tank Battle, Reaction Time, Blind Maze, One Man and His Dog, Life.
Game Pack 4 — Poker, Pontoon, Roulette, Othello, Stock Broker.
(Sharp only)
Adventure Games
Devils Triangle — Sail to Bermuda but beware of the Bermuda Triangle! — £5.00.
Earth Rescue — Search the Galaxy for a rare mineral needed for Earths survival — £5.00.
King of the Valley — Try to control a kingdom and its people — £3.00.
Desert Patrol — Find your way across a desert but beware of its inhibitants! — £4.00.
Educational
Maths Tutor — A set of programmes designed to teach maths to children from 3-10 yrs. — £5.00.
Word Quiz — Find the hidden words in a jumble of letters — £3.00.
Send cheque/PO or SAE for details to

Abacus Software
20 Rhosleigh Ave.
Sharples Park
Bolton BL1 6PP.

Atom Acorn fully expanded never used game cassette. Only £120. Phone 591 6650 after 5.
2/2

SELL IT WITH YOUR COMPUTER CLASSIFIED ORDER FORM

Classified Rates

Linage: 30p per word (Min 15 words) — prepayable

Linage advertisers should complete the form provided in BLOCK CAPITALS. Phone number counts as 2 words. Name and address to be paid for if used in advertisement. Box Number if required is £3.00 extra.

Display — rates per scc (Min 2scc)

One Insertion	:	£7.00
Three Insertions	:	£6.70
Six Insertions	:	£6.50
Twelve Insertions	:	£6.00

Display advertisers should provide separate copy and preferably reserve space by phone (01-661 3031).

Method of Payment

Cheques etc, should be made payable to IPC Business Press Limited and crossed "& Co" I enclose herewith cheque/PO for

£ . . . .

Please debit my Access/Visa Barclay Card/American Express/Diners Club Int/ /as below

SIGNATURE

Post to:

Cut out the order form and return together with your remittance to: Classified Department, Your Computer, Room H211, Quadrant House, The Quadrant, Sutton, Surrey SM2 5AS. (01) 661 3031

Please insert the following advertisement in Your Computer Classified Section

					LINAGE
					£4.50
					£6.00
					£7.50
					£9.00
					£10.50
					£12.00
					£13.50
					£15.00

No. of insertions required ☐ Box No. required YES/NO

NAME *(Please include initials)*. . . . .

ADDRESS . . . .

Payment by credit card please state address card is registered

Daytime tel. no . . . .

THIS FORM SHOULD BE RETURNED BY FEB. 28 FOR APRIL ISSUE PUBLICATION



At last! The thing Jupiter Ace owners have waited patiently for.
A minimum of 16K RAM plus the added benefit of extending to 32K by a simple plug-in module!
Now you can start to program seriously in FORTH without the restriction of 3K RAM.
Make no mistake. Not only is the PACER the first RAM pack for the Jupiter Ace, it is a totally professional piece of equipment.

Look at just some of the features:—

*** 16K RAM expandable to 32K * Professionally cased to enhance the look of your computer * LED Power-on indicator * Wobble free connection — no loss of programs! * A fully tested product * Complete with 1 year's full warranty.**

The NEW "PACER" is available now direct from STONECHIP ELECTRONICS.
Write now for quick delivery by mail.
Remember: For more power from faster FORTH . . . you need a PACER!

only £29.95

DEALER ENQUIRIES WELCOME

POST TODAY to STONECHIP ELECTRONICS, Unit 9, The Brook Industrial Estate, Deadbrook Lane, Aldershot, Hants. (Telephone: 0252 318260)

Please forward me the following:—
...... "PACER" RAM packs for the Jupiter Ace @ £29.95.
...... 16K expansion modules (to expand "PACER" to 32K) @ £19.95.
I enclose full remittance of £............ made payable to Stonechip Ltd.
Please note: All prices include VAT, Post & Packing for U.K. deliveries (overseas add 15%)

Name: ....

Address: ....

....

....

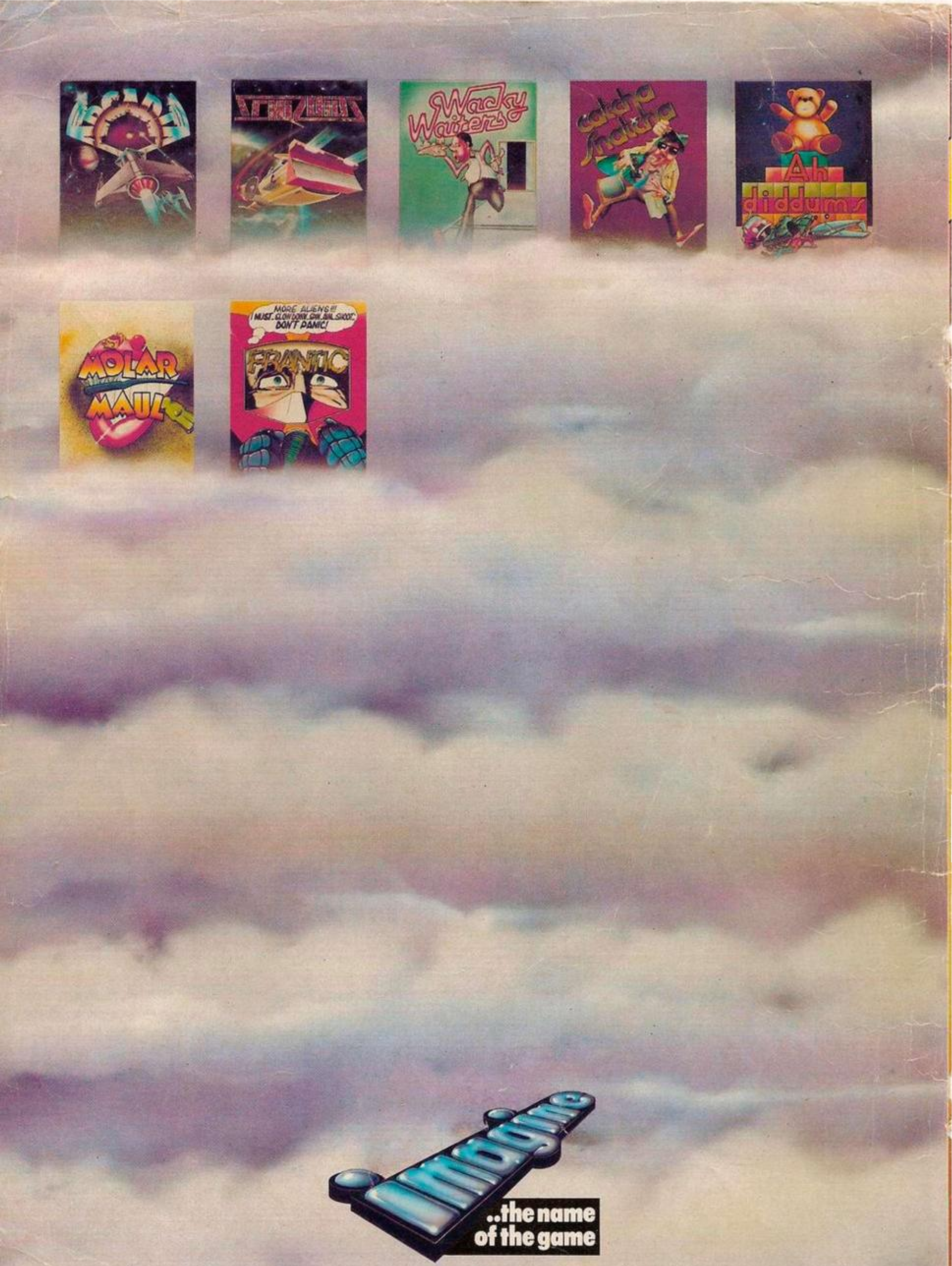
STONECHIP ELECTRONICS

"More ways to make more of your computer"

Delivery approx 14 days

Y

ADVERTISEMENT INDEX


Wacky Waiters
Catcha Snatcha
Ah diddums
MORE ALIENS!!
DON'T PANIC!
FRANTIC
MOLAR MAUL
Imagine
..the name of the game

747901

YC5